IRONDALE DBCP CONTROL SYSTEM

ROCKY MOUNTAIN ARSENAL

REVIEW OF 1987/1988 OPERATIONS

PREPARED BY

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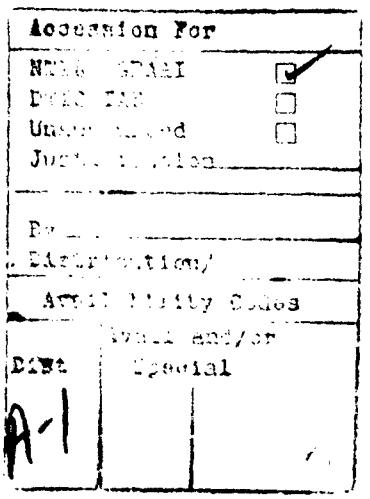

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THIS REPORT SUMMARIZES THE OPERATION OF IRONDALE DBCP CONTROL SYSTEM ON THE RMA DURING CALENDAR YEARS 1987 AND 1988. WATER TABLE CONTOUR MAPS AND DBCP ISOCONCENTRATION MAPS HAVE BEEN PREPARED WHICH PROVIDE AN OVERALL DEPICTION OF THE DBCP (1,2-DIBROMO-3-CHLOROPROPANE) PLUME AND ITS CONTROL BY THE SYSTEM.

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EXECUTIVE SUMMARY

This report summarizes the operation of Irondale DBCP Control System ("the system") on the Rocky Mountain Arsenal (RMA) during calendar years 1987 and 1988. Water table contour maps and DBCP isoconcentration maps have been prepared which provide an overall depiction of the DBCP (1,2-dibromo-3-chloropropane) plume and its control by the system.

No DBCP was detected in residential wells which were monitored in the Irondale community during the period. Further, no DBCP was detected in the six monitoring wells on the RMA downgradient of the recharge wells.

The unconfined alluvial aquifer exhibited similar seasonal flow fluctuations during the period as in previous years. The contaminate plume continues to decrease in concentration to approximately 0.3 parts per billion DBCP as it travels through the thin bedrock alluvium channel toward the control system. The groundwater mound created by the line of injection wells effectively prevented the soluble DBCP plume from migrating off the site. Groundwater flows to the control system were converging to the line of intercepting wells where on average 1000 to 1200 gpm of groundwater was recovered and pumped to the treatment system. The activated carbon system effectively removed detectable quantities of DBCP. The system was operated with an overall stream factor of 98% during the period. The end result was that monitoring wells downgradient of the facility did not indicate detectable levels of DBCP, demonstrating that the system is effective in preventing the migration of DBCP off the Rocky Mountain Arsenal.

I. BACKGROUND

In March 1980, DBCP (1,2-dibromo-3-chloropropane) was discovered in some of the water wells producing from the alluvial aquifer in the Irondale community, located along the Northwest Boundary of RMA. A map of RMA and Denver vicinity is shown in Plate 1.

Chemical and groundwater level data developed subsequent to March 1980 from the limited number of monitoring wells which existed at that time indicated that DBCP-contaminated groundwater was moving off RMA at the northwest corner of Section 33. The data also indicated the contaminated groundwater extended northwest from the area of the rail classification yard in Section 3.

In order to eliminate the migration of contaminated groundwater, Shell Chemical Company constructed a control system, known as the Irondale DBCP Control System, in the northwest corner of Section 33. A plan view of the original system is shown in Plate 2. The system was designed to intercept the contaminated alluvial aquifer, remove the contaminant from the water, and inject the treated water back into the alluvial aquifer. The original system was composed of the following:

- Two rows of dewatering wells - 15 wells in Row 1 (front or undip row) and 18 wells in Row 2 (rear row).
- A common feed sump - 40M gallon capacity.
- Two up flow, pulse bed, granular activated carbon (40M lbs each) adsorbers operating in parallel.

carbon modular defining system was installed in February, 1984. This system was coupled with a 40,000 lb bulk virgin carbon storage tank in November, 1984.

II. PURPOSE AND SCOPE

The purpose of this report is to review 1987 and 1988 operations of the system and to assess its effectiveness for removing DBCP from the alluvial aquifer approaching the Irondale community. Reports presenting evaluations of the Irondale DBCP Control System for the periods of December, 1981 to September, 1984 were prepared by the U.S. Army Engineer Waterways Experimental Station (WES) in Vicksburg, Mississippi and issued in December, 1984 (RIC 84065R01 and 85130R01). A draft report for 1985 FY was prepared by WES. However, the final report has not been issued. A report for the 1986 calendar year was prepared by Shell and issued in July 1987.

The geology and hydrology associated with the system and surrounding area were discussed in the December, 1984 Waterways Report and will not be repeated here.

III. SYSTEM OPERATIONS AND FACILITY ALTERATIONS

A. Operational Summary

Weekly average total flow rates through the two GAC adsorbers, which were operated in parallel, are presented in Plates 5 and 6. Operational factors and incidents which effected the quantity of flow through the system are presented in Appendix A. Total flow through the system in 1987 ranged ranged between 1,032 gpm to 1,601 gpm and averaged 1,339 gpm. In 1988, the flow through the

system ranged 847 gpm to 1,467 gpm and averaged 1,221 gpm.

Both carbon treatment vessels operated at a 99+% stream factor in 1987, with 33 hours downtime for V-101 and 32 hours for V-102. In 1988, the system experienced more downtime because of corrosion problems with V-101 which necessitated repairs to the vessel and modifications to the system to install a third carbon treatment vessel, V-103. Total downtime for V-101/V103 was 126 hours for a 98.6% stream factor. V-102 downtime was was 139 hours for a 98.4% stream factor.

Biweekly influent and effluent DBCP concentrations for the carbon adsorption system are detailed in Appendix B, which contains copies of quarterly analytical data reports which were submitted to the Army and Colorado Department of Health. The data may be summarized as follows:

		DBCP, ppb		
		Influent		
Vessel	Year	Range	Average	Effluent
V-101	1987	0.28-0.43	0.34	BDL[1)]
V-102	1987	0.16-0.39	0.30	BDL
V-101/103	1988	0.18-0.45	0.37	BDL
V-102	1988	0.18-0.42	0.29	BDL[2)]

1) BDL = Below Detection Limit of 0.06 ppb DBCP.

2) On Sept. 26, 1988, an effluent analysis suggested the presence of DBCP above the detection limit, but below the level of determinability (0.20 ppb).

Appendix B also contains DBCP analytical data for selected extraction wells which were analyzed on a quarterly basis.

B. Alterations and Repairs

A problem existed in the plant whereby carbon fines from the building drain system entered the dewatering sump and were circulated to the pre-filter associated with the carbon adsorbers. Excessive use of filters had created an ongoing disposal problems for the spent filter cartridges. In 1987, a decanting sump was installed adjacent to the existing sump which allowed gravity separation of carbon fines which then can be sent to the spent carbon storage tank. This revised system has resulted in a 60% reduction in use of disposable cartridge filters.

To improve the operability of the Irondale groundwater treatment facility, it was determined to be advantageous to obtain electrical power from the Public Service Company of Colorado lines which were nearby. This new source of electricity was placed on line in September 1978 and has resulted in lower power cost and less down-time resulting from electrical power disruptions.

On May 13, 1988, a one-eighth diameter hole was found in the bottom dished head of the carbon adsorber, V-101. The hole was located where the inlet flange was welded to the bottom head. A wooden plug was driven in the hole to stop the leak. A decision was made to purchase and install a third carbon vessel (V-103) as a spare which would allow for repair of V-101. An identical prefabricated adsorber vessel was located in Phoneix, Arizona. The new vessel arrived June 24, 1988. The vessel was visually inspected and the internal lining was subjected to a high voltage spark test. After installation on a new foundation and piping connections, the vessel was

loaded with 40,000 lbs of defined, virgin carbon. Upon completion of hydrotesting, the new vessel was placed in service on July 8, 1988.

With a replacement vessel (V-103) online, it was possible to discontinue operation of V-101. Removal of the 40,000 lbs of spent carbon in V-101 began on July 11, 1988. Difficulty was experienced due to plugging with large chunks of carbon. A complete internal inspection was made including spark testing of the liner. Severe corrosion had taken place at the four bottom nozzles resulting in complete penetration of one nozzle through the bottom dished head. The corrosion originated at the top sharp 90 degree edge where the paint lining failed.

A new nozzle was ordered from the original fabricator of the vessel with A.S.M.E. code partial data certification. A certified A.S.M.E. code repair shop was contracted to make all weld repairs and final inspection. The other three nozzles were also repaired and sharp corners were eliminated. A coating contractor grit blasted the bottom head and nozzles to NACE-1 white metal prior to coating with a compatible 40 mil lining. A final spark test of the facilities was on September 30, 1988. V-101 will be filled with 40,000 lbs of defined virgin carbon in 1989 and placed back in service.

In the future, V-102 which has never been inspected will be emptied of spent carbon, cleaned and inspected. It will be repaired as required and refilled with defined virgin carbon. The system will then have an installed spare adsorber.

IV. DATA EVALUATIONS

A. WATER TABLE CONTOUR MAPS

Water table contour maps have been prepared for the sections around the Irondale DBCP Boundary Control System and are located in Appendix C. These maps are produced based on the data collected during the sampling periods 1/87, 4/87, 7/87, 10/87, 4/88, and 10/88. The data collected at Section 2, 27, and 35 during the 10/87 sampling period are used to supplement the data base and contouring for the two sampling periods in 1988. In addition, magnified water table contours near the intercepting system are produced for the sampling periods 4/88 and 10/88.

These maps indicated that the general flow direction during the past two years has not significantly changed. Based on the magnified water table contours, the control system has functioned properly. The groundwater mound created by the line of injection wells should prevent the soluble DBCP plume from migrating off the site. In addition, groundwater flows to the southeast of the system are converging to the line of intercepting wells.

B. DBCP ISOCONCENTRATION MAPS

The 1987 DBCP Sample Period Data

The DBCP isoconcentration contours for the April and October sampling periods in 1987 are plotted on maps located in Appendix D. The DBCP concentration data associated with these maps is also located in Appendix D. The location of monitoring wells on and off the RMA are described in Plate 7. The highest concentration was found in samples collected from Well No. S-23 located near the rail classification holding yard. As in the

past, Well No. Army 26, appears to reflect the diluted DBCP concentration level seen in Well S-23. The plume concentration continues to decrease in the direction of flow in a relative narrow path toward the Irondale DBCP Control System and principally follows the thin bedrock alluvium channel. DBCP was detected in only one well of the downdip extraction row: 0.10 ppb and 0.07 ppb in W-2 during 1987. No DBCP concentration at or above the detection limit (0.06 ppb) was detected in either the system monitoring wells immediately downdip of the row of injection wells or in monitoring wells in the Irondale community.

As in the past upward and downward concentrations are believed to reflect varying patterns and magnitudes of precipitation events in the general area that influences the local groundwater level fluctuations in the alluvial aquifer.

The thin bedrock alluvium aquifer is hydraulically connected to a deeper alluvium channel just southwest of the plume path. In the deeper alluvium channel the SAW&SD has four municipal wells located at two sites. The nearest is one-half mile west of the DBCP Control System at 77th and Quebec Avenue and another west of these wells at 77th and Potomac. These wells operate on a intermittent basis and are mainly continuous used during May to September. The municipal well pumping has again effected the shape of the plume. The effect of shifting extraction volumes to the northeast end during the winter months exhibits the approximate same seasonal fluctuation in 1987 as in previous years and may be seen in the plume flow in the updip row of extraction wells for April, 1987 as compared to the October, 1987 data.

The 1988 DBCP Sampling Period

The DBCP isoconcentration contours for the April and October sampling periods in 1988 are located in Appendix D. The DBCP con-

centration data associated with these maps is also located in Appendix D. As in 1987, the highest concentration was found in samples collected from Well No. S-23. The Well No. Army 25 has a lower DBCP concentration than last year, which is attributed to past low concentrations seen in Well No. S-23. This was thought to be influenced by groundwater table fluctuations. The plume continues to follow in a relative narrow path and in the same thin bedrock alluvium channel. The DBCP concentrations in the updip extraction row are higher as was observed in undip monitoring wells in 1987. Because of these higher concentrations and pass through between the updip extraction row, DBCP was found in the southwest extraction row Wells No. W-2, W-4, W-8, W-12 and W-33. No DBCP concentration at or above the detectable limit of 0.06 ppb has been detected downdip of the injection well row or in the Irondale community. The plume shifting at the extraction rows again is exhibited by the same seasonal fluctuation in 1988 as in previous years.

C. TCE DATA

At the request of the Army, we began analyzing the groundwater feed to the carbon adsorbers for the presence of TCE (trichloroethylene). The detection limit for the analysis of TCE was 1 ppb. Analysis of a water sample taken during the first, second, and third quarter periods did not indicate the presence of TCE. During the fourth quarter sampling, TCE was detected at a concentration of 2 ppb. Reanalysis of the untreated and treated water a month later, however, did not indicate the presence of the compound.

V. CONCLUSIONS

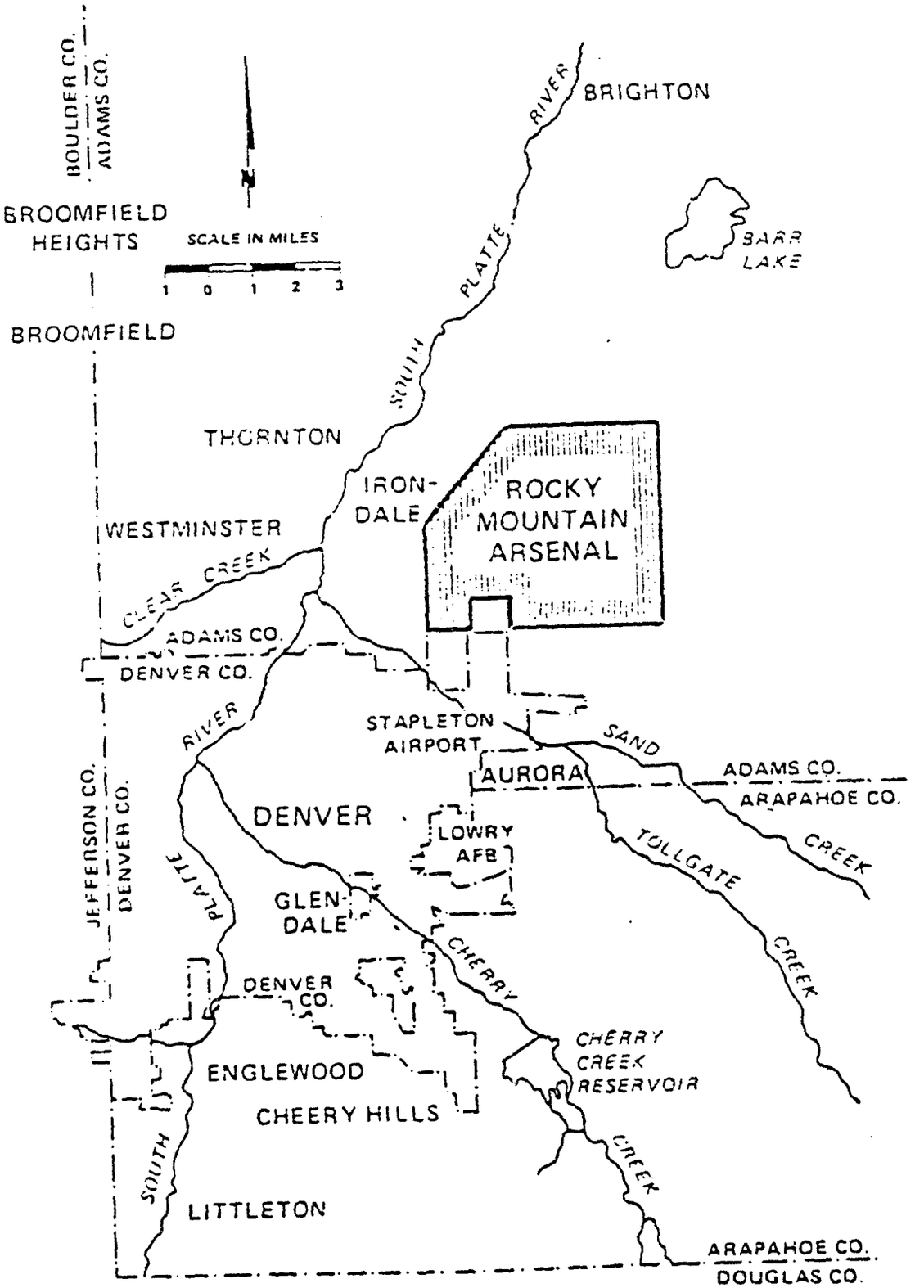
1. The unconfined alluvial aquifer exhibited the approximate same seasonal fluctuations in 1987 and 1988 as in previous years.

2. No DBCP was detected in monitored wells in the community of Irondale during the period, nor was DBCP detected in the row of system monitoring wells immediately downgradient of the injection wells.

3. The main cause of downtime for the system was equipment corrosion and electrical power interruptions. These problems have been effectively ameliorated by the installation of a third (installed spare) carbon treatment vessel and obtaining an alternative and cost effective power supply from Public Service Co. of Colorado.

4. The DBCP isoconcentration contour maps and water table contour maps prepared basis the 1987 and 1988 data indicate the control system is effectively intercepting and removing DBCP contaminated groundwater flowing toward the community of Irondale.

PLATE 1
MAP OF RMA, DENVER VACINITY



MAP OF RMA
DENVER VICINITY

PLATE 1

PLATE 2
DBCP CONTROL SYSTEM (PLAN VIEW)

IRONDALE DBCP CONTROL SYSTEM

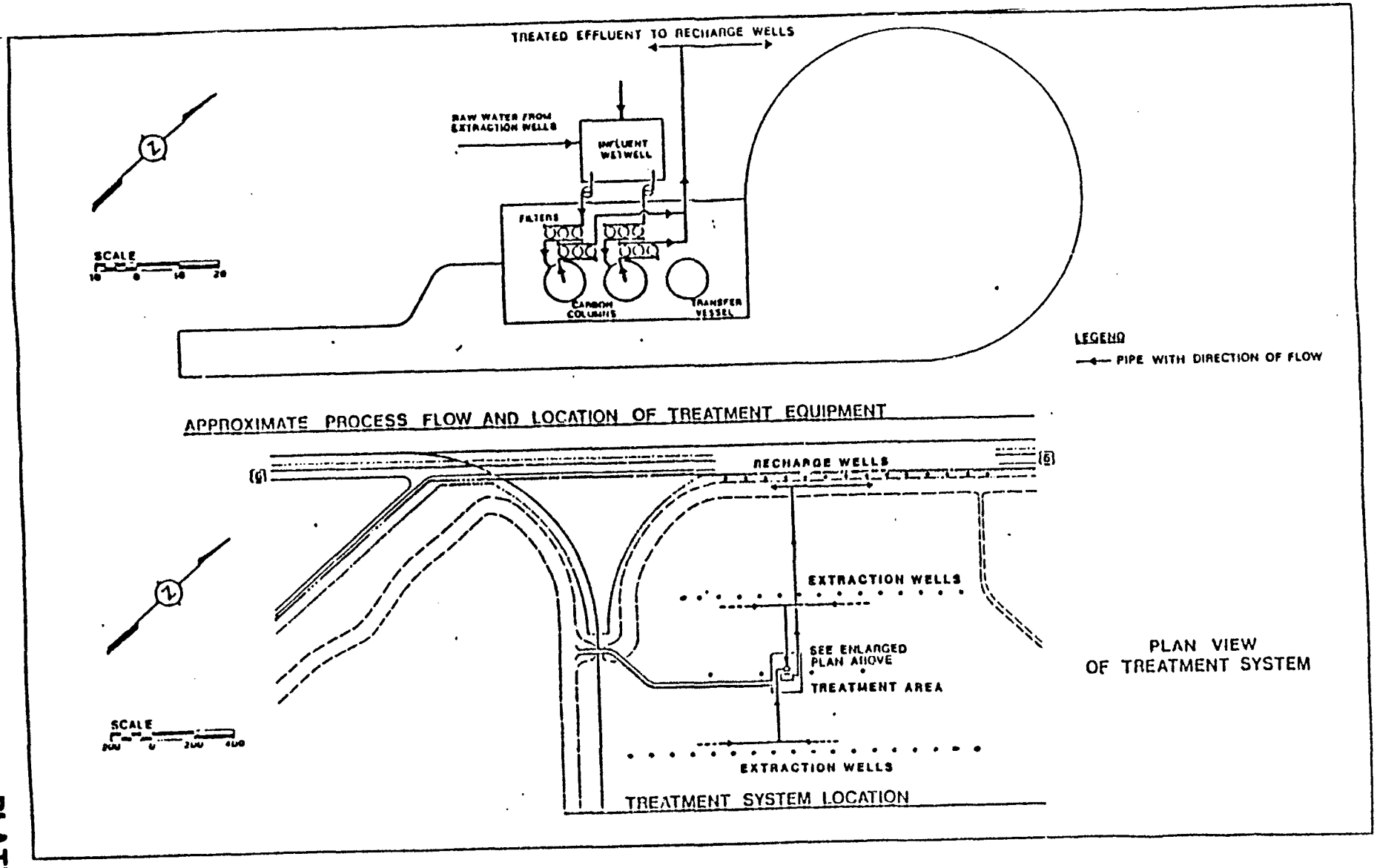
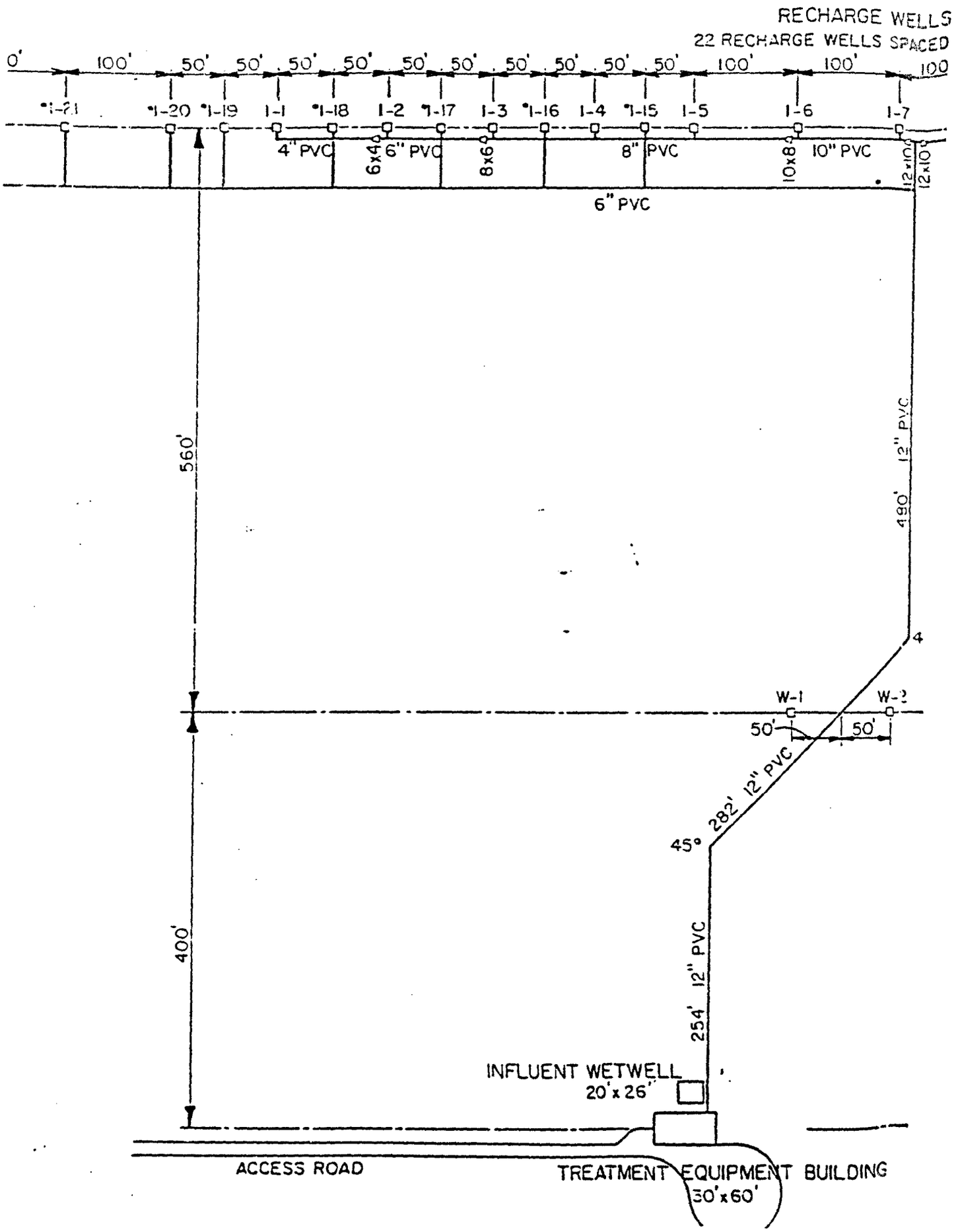
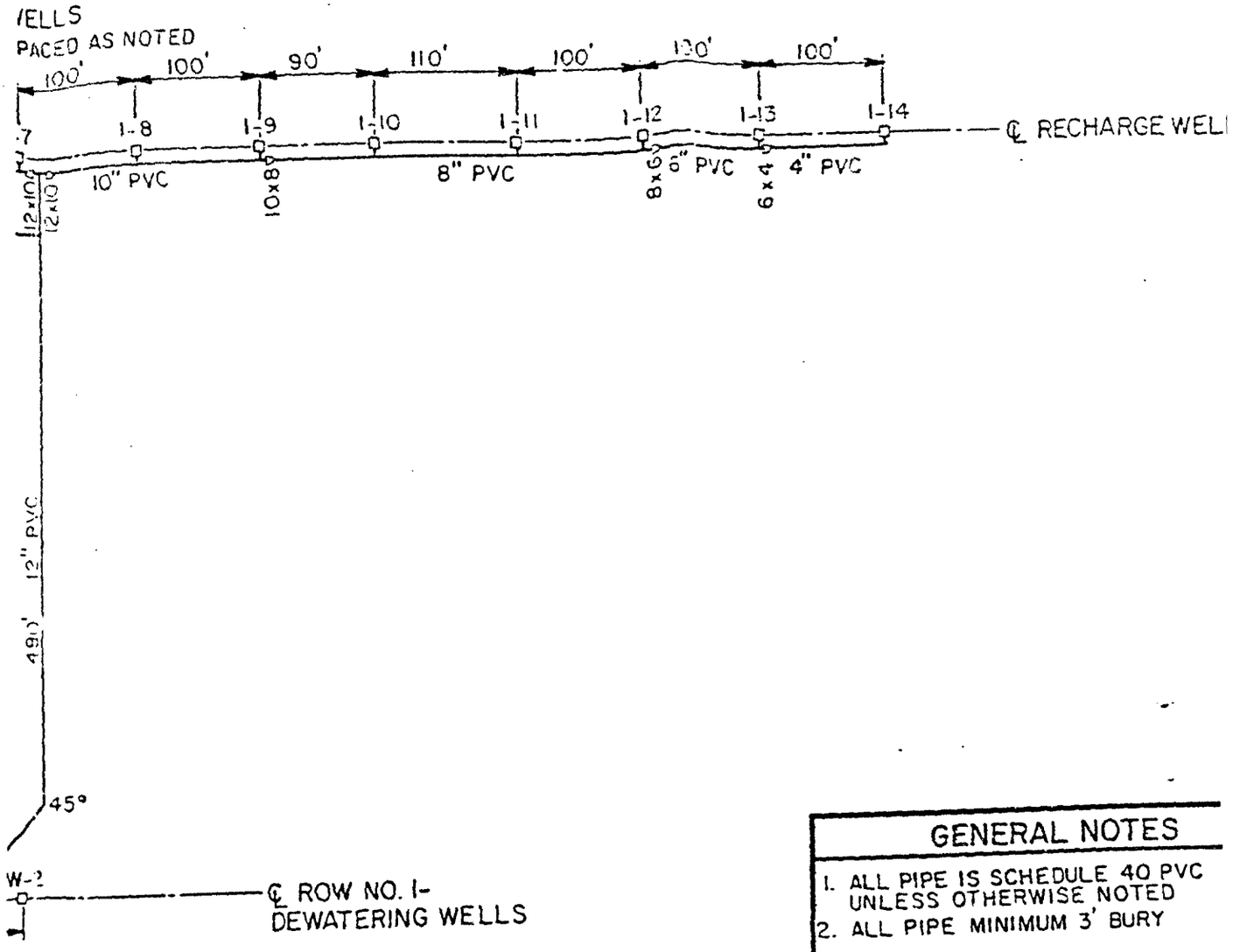


PLATE 2

PLATE 3
RECHARGE DISTRIBUTION SYSTEM


RECHARGE WELLS
22 RECHARGE WELLS SPACED
0'
100'
50'
50'
50'
50'
50'
50'
50'
50'
50'
50'
100'
100'
100
I-21
I-20
I-19
I-1
I-18
I-2
I-17
I-3
I-16
I-4
I-15
I-5
I-6
I-7
4" PVC
6x4
6" PVC
8x6
8" PVC
10x8
10" PVC
12x10
12x10
6" PVC
560'
490'
12" PVC
4
W-1
W-2
50'
50'
282'
12" PVC
45°
400'
254'
12" PVC
INFLUENT WETWELL
20'x 26'
ACCESS ROAD
TREATMENT EQUIPMENT BUILDING
30'x60'



GENERAL NOTES

1. ALL PIPE IS SCHEDULE 40 PVC UNLESS OTHERWISE NOTED
2. ALL PIPE MINIMUM 3' BURY

REFERENCE:
RUSEL AND HAGER, INC.
CONSULTING ENGINEERS,
TUSCON, ARIZONA
DRAWING NO. AA-1-021
REV. 1, 7-23-81
• ADDENDUM

SHELL CHEMICAL COMP
A DIVISION OF SHELL OIL COMPANY

IRONDALE DBCP CONTROL SYS
RECHARGE DISTRIBUTION SYST
PIPING PLAN

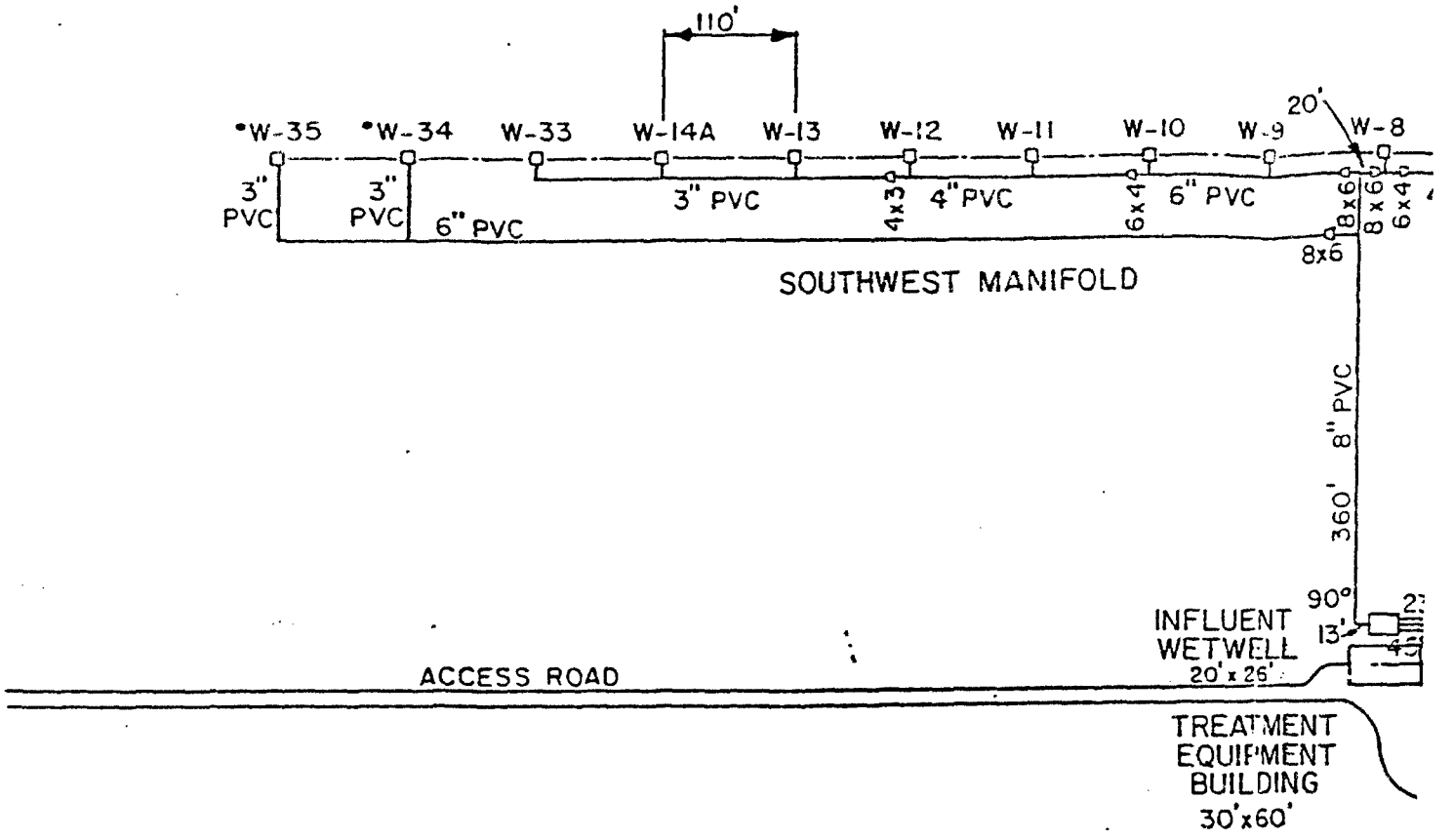
SCALE:	1" =120'	APPROVED: EV
DATE:	7-18-86	CHK. APPR.: W
DRAWN:	SMR	

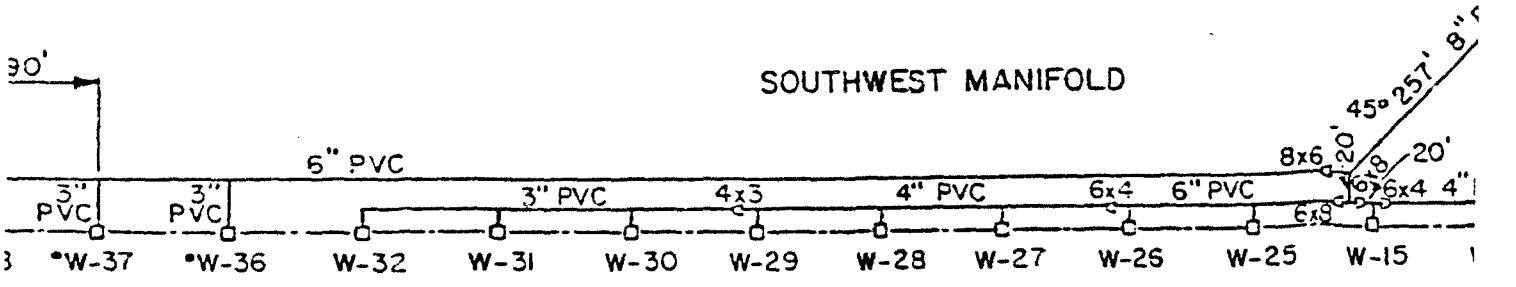
PLATE

PLATE 4
DEWATERING WELL COLLECTION SYSTEM

ROW NO. 1

17-DEWATERING WELLS SPACED AT 100 FEET - EXC



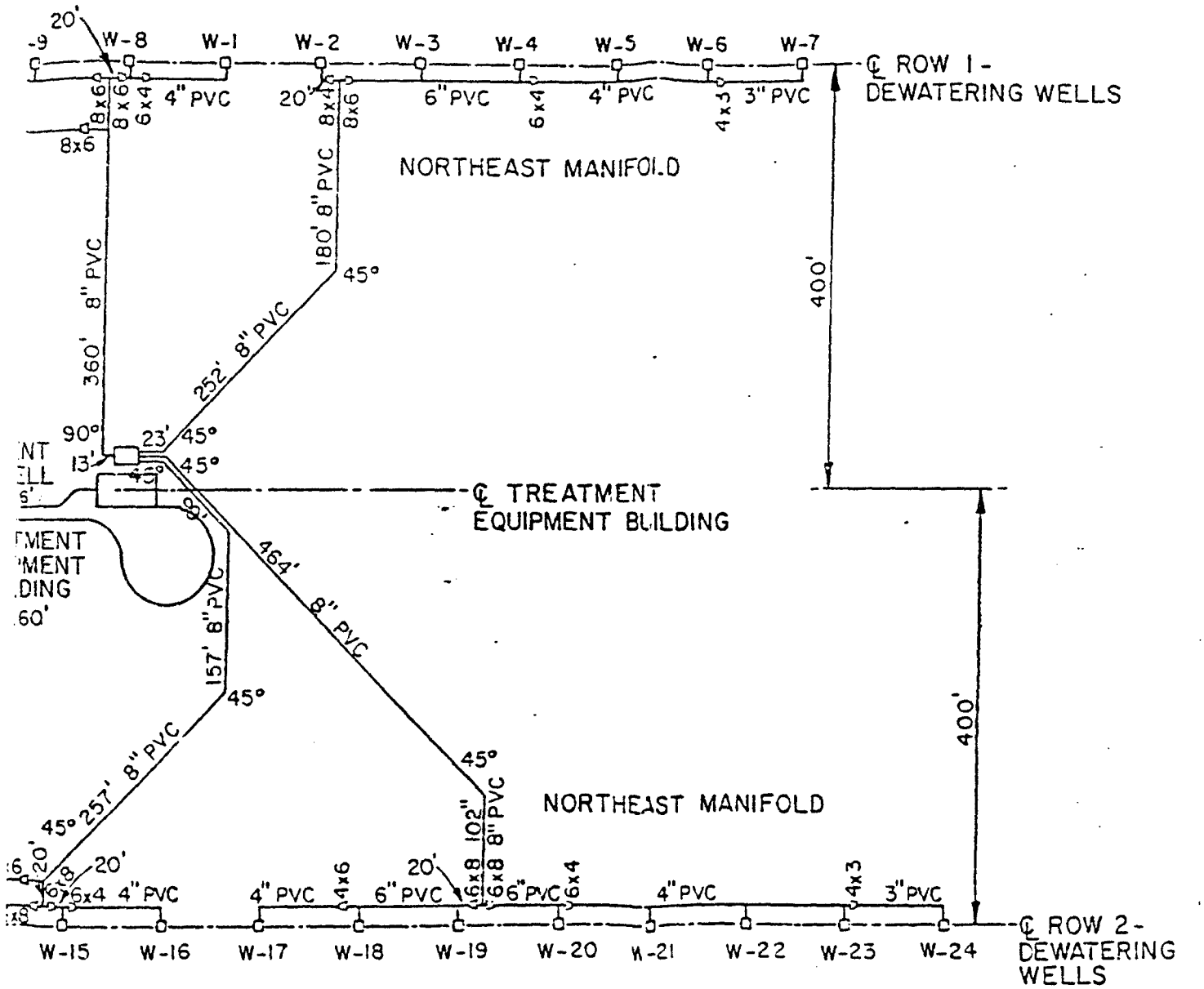


ROW NO. 2

21-DEWATERING WELLS SPACED AT 100 FEET - EXCEP

1. ALL PIPE IS SCHEDULE 40 PVC UNLESS OTHERWISE NOTED.
2. ALL PIPE MINIMUM 3' BURY.

). 1
)0 FEET - EXCEPT AS NOTED



2
EET - EXCEPT AS NOTED

REFERENCE:
RUBEL AND HAGER, INC.
CONSULTING ENGINEERS,
TUSCON, ARIZONA
DRAWING NO. AA-1-020
REV. 1, 7-23-81
• ADDENDUM

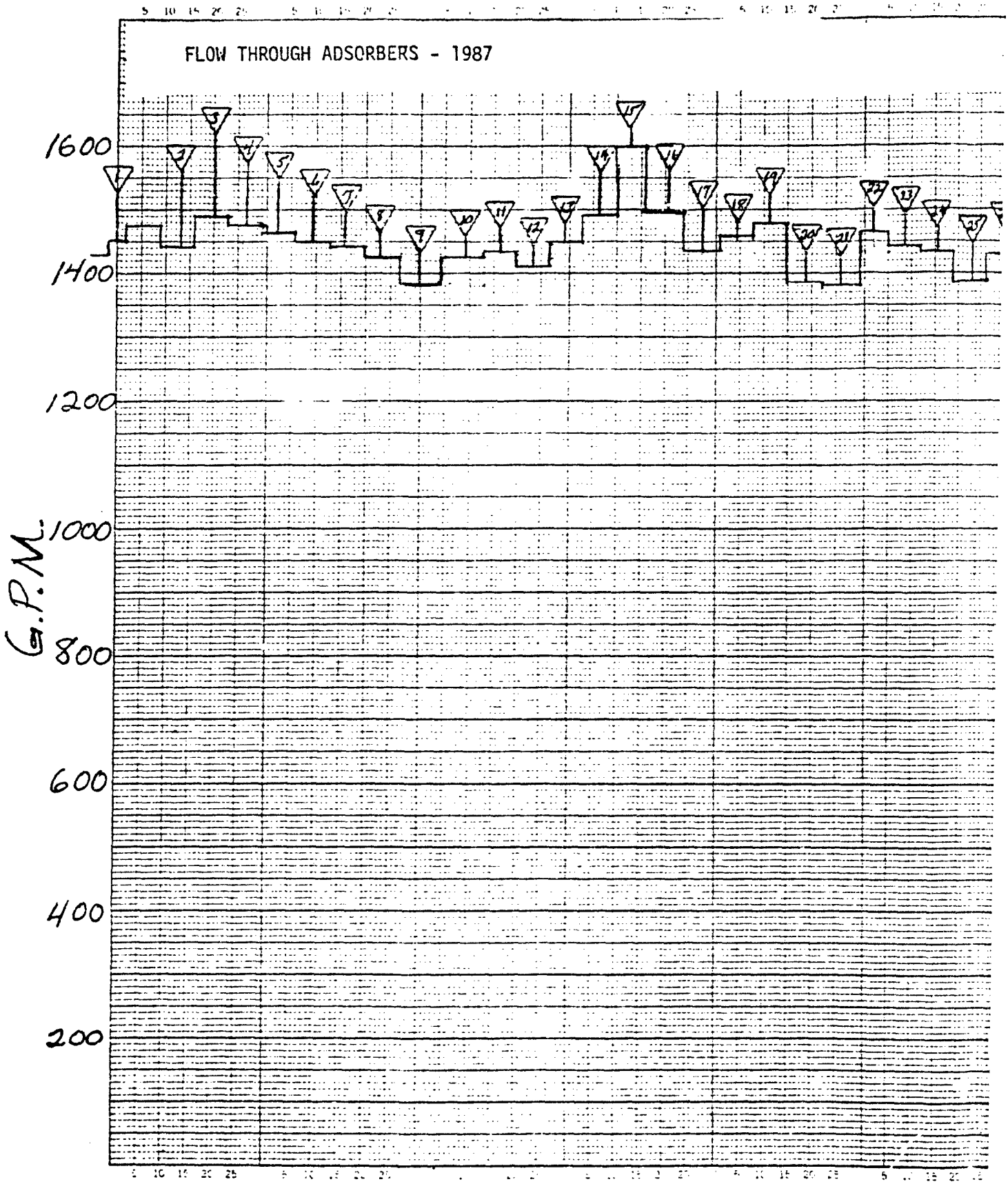
SHELL CHEMICAL COMPANY
A DIVISION OF SHELL OIL COMPANY
DENVE

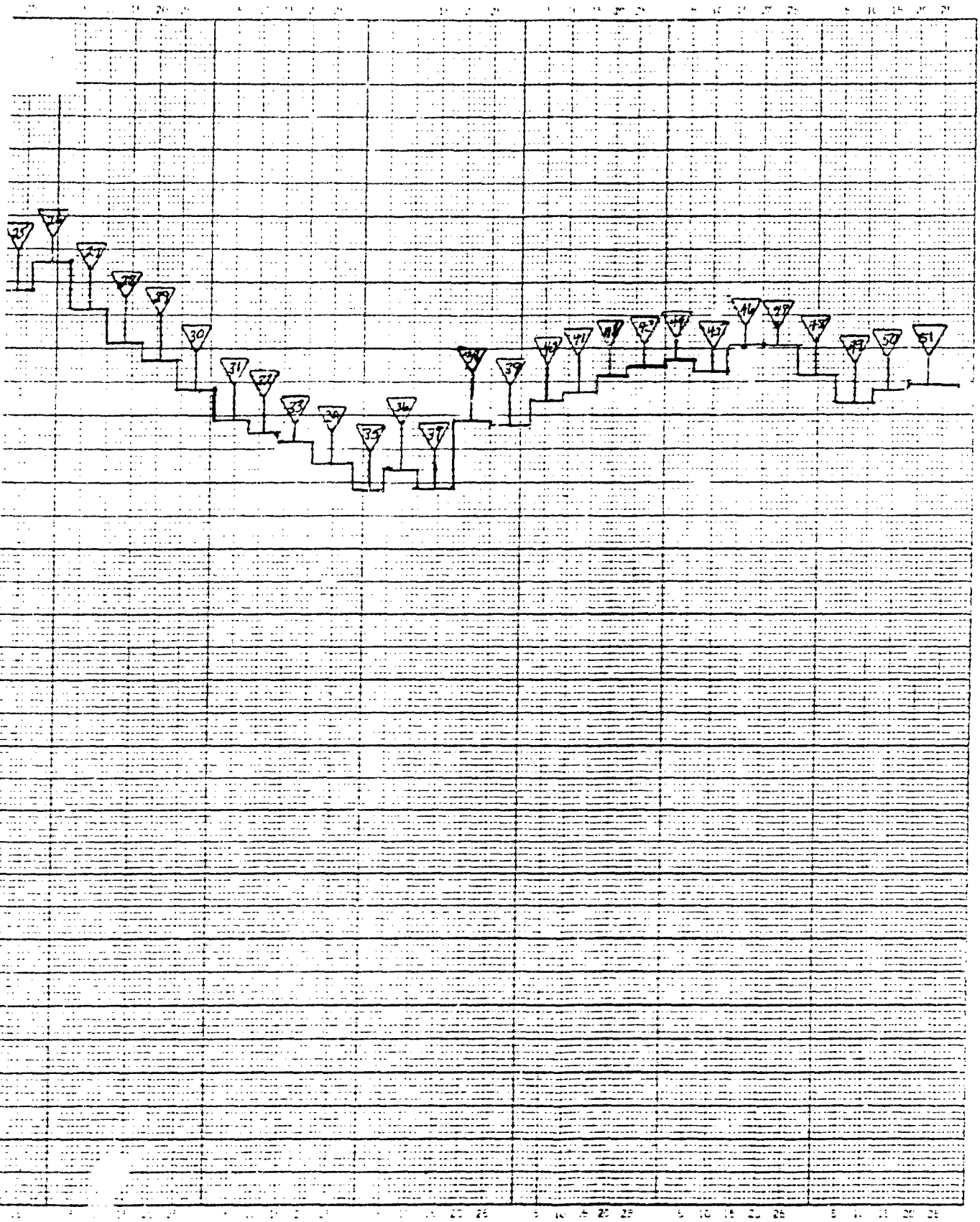
IRONDALE DBCP CONTROL SYSTEI

DEWATERING WELL COLLECTIO SYSTEM
PIPING PLAN

SCALE: 1" = 150'	APPROVED: EWS
DATE: 7-18-86	CHK. APPR.: WM
DRAWN: SMR	
CHECKED:	PLATE 4

PLATE 5
FLOW THROUGH ADSORBER - 1987

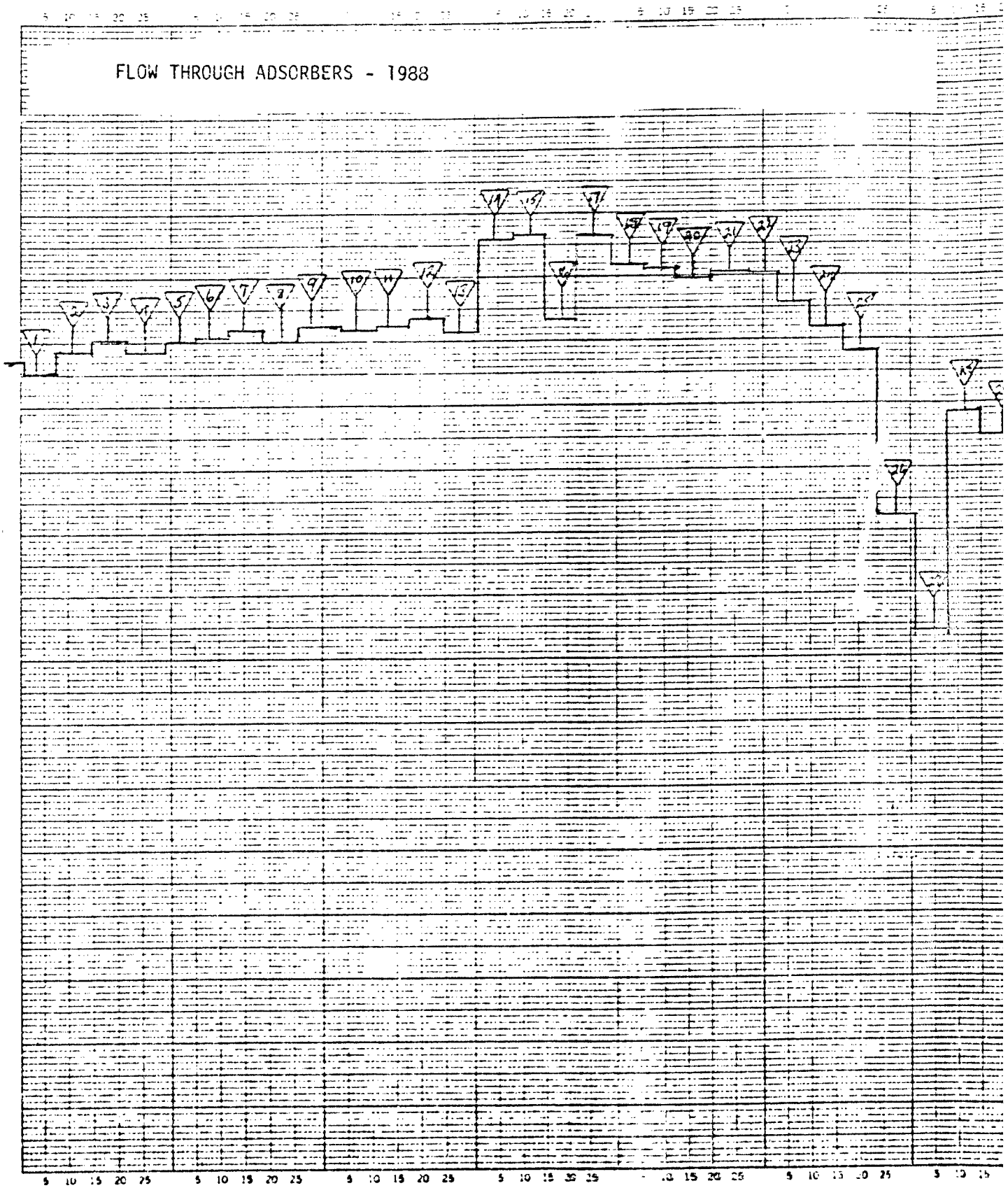

FLOW THROUGH ADSORBERS - 1987
1600
1400
1200
1000
800
600
400
200
G.P.M.
Jan.'87
Feb.
Mar.
Apr.
May
June

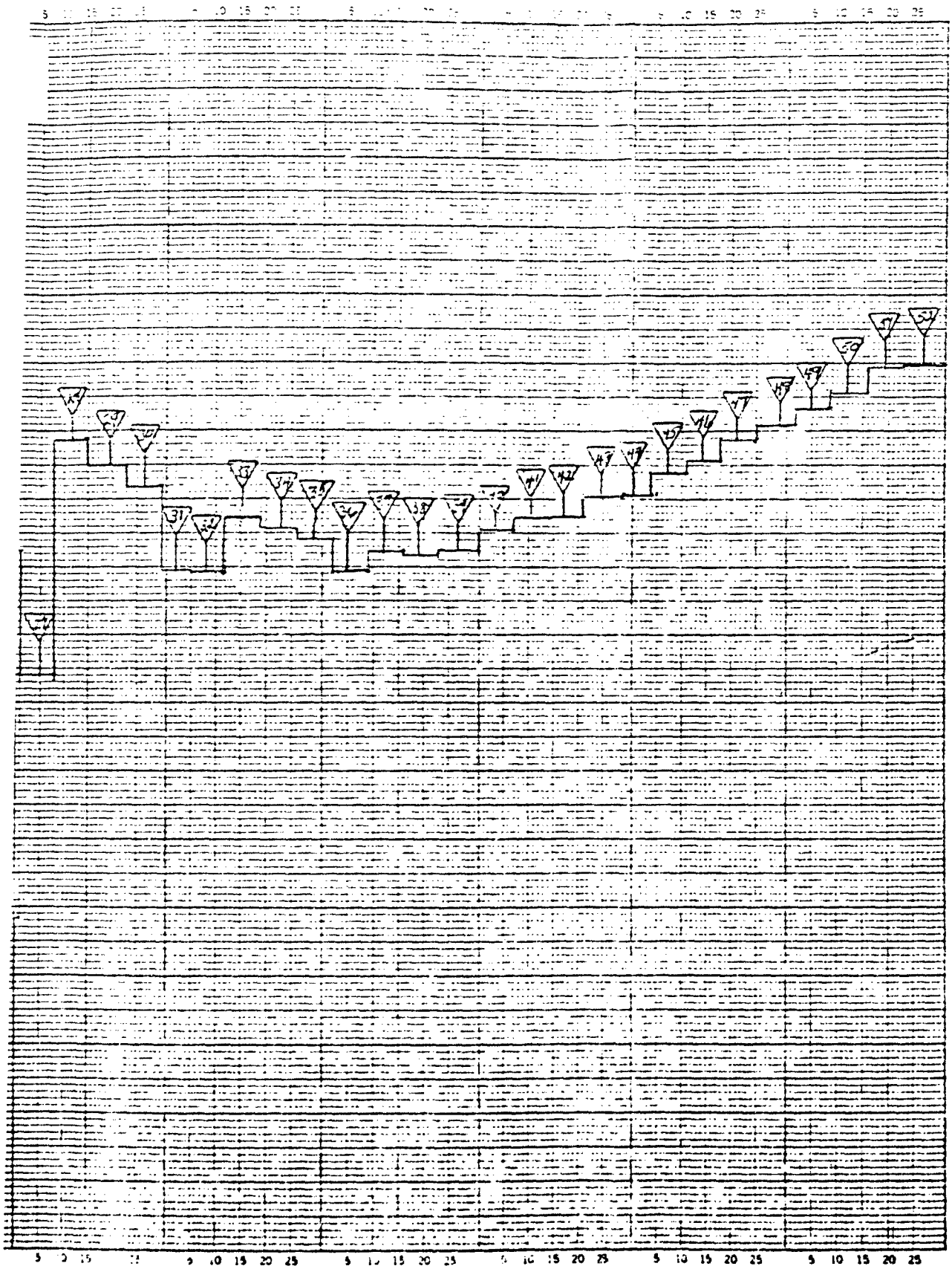


ve July Aug. Sept. Oct. Nov. Dec.

PLATI

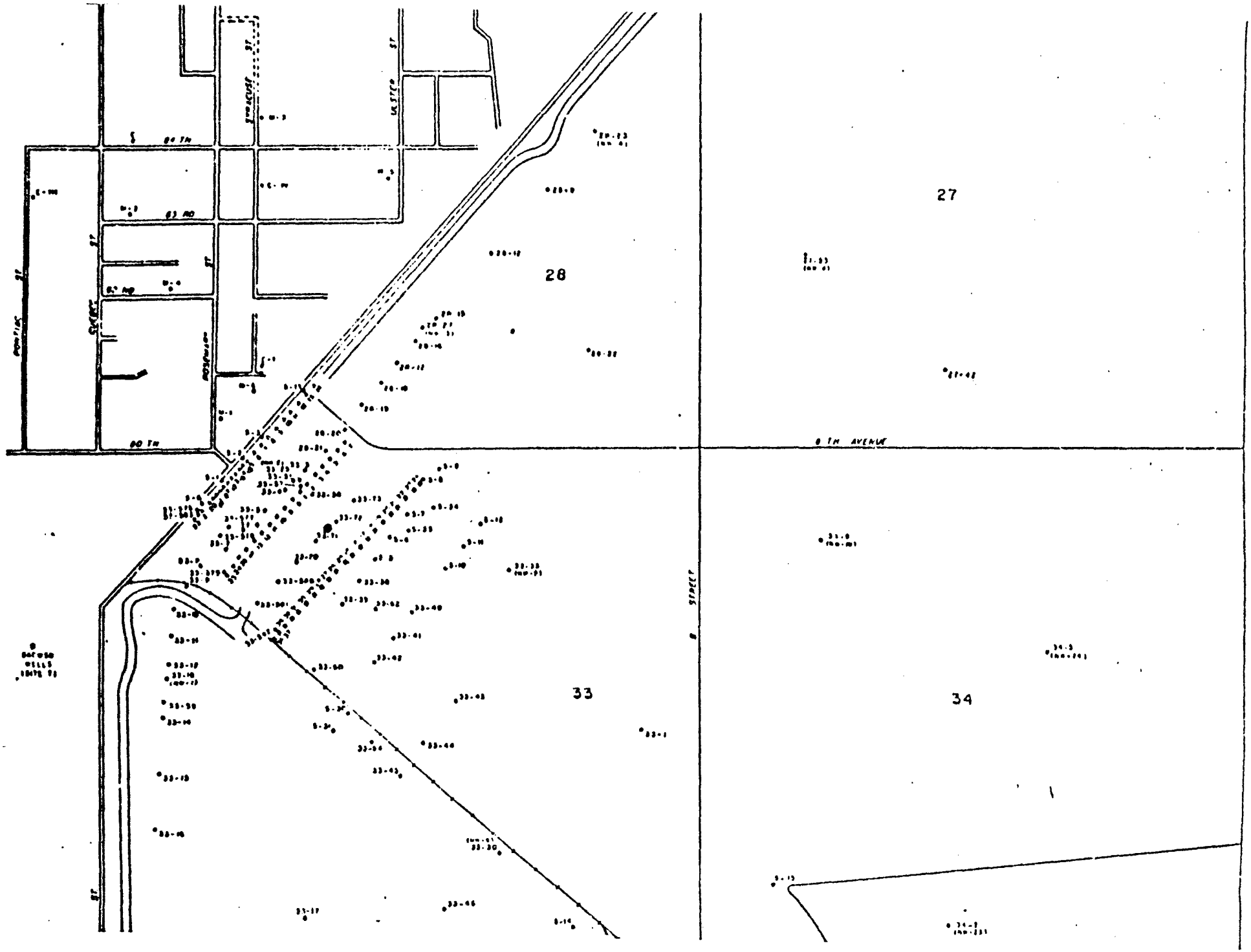
PLATE 6
FLOW THROUGH ADSORBER - 1988

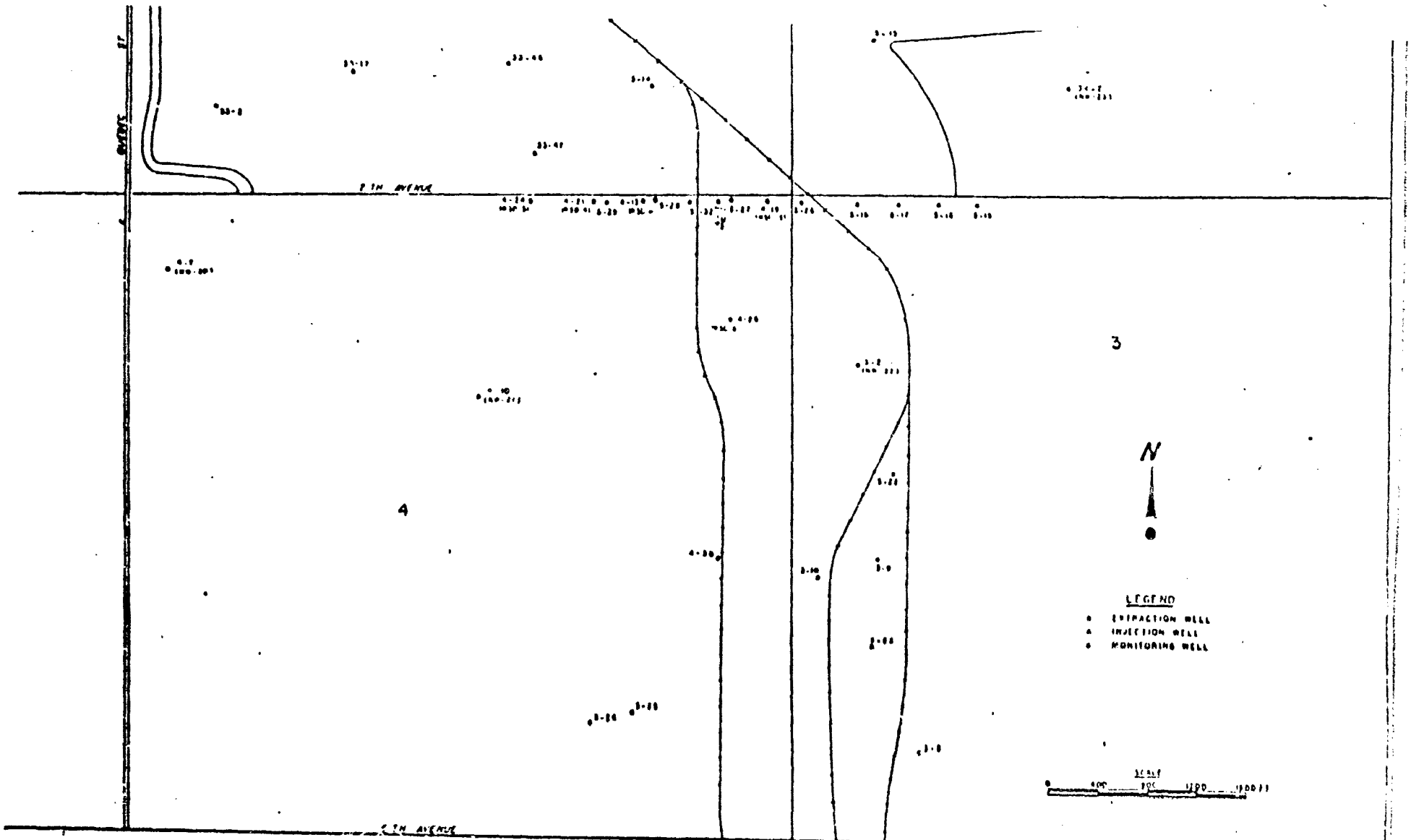

FLOW THROUGH ADSORBERS - 1988
Jan.88
Feb.
Mar.
Apr.
May
June
Jul


5 10 15 20 25
5 10 15 20 25
5 10 15 20 25
5 10 15 20 25
5 10 15 20 25
July
Aug.
SepT
OcT.
Nov.
Dec

PLATE

PLATE 7
LOCATION OF DBCP MONITORING WELLS


27
28
33
34
8 TH AVENUE
8 STREET
60 TH
63 RD
64 TH
SYRACUSE ST
UTICA ST
PONTIAC ST
ROSEVILLE



PREPARED FOR
DEPARTMENT OF THE ARMY
ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO

IRONDALE DBCP CONTROL SYSTEM

APPENDIX A
OPERATIONAL FACTORS AND INCIDENT EFFECTING FLOW RATES - 1987/1988

"1987" DATES - INDICATING ACTIVITY DURING WEEK ENDING.
OPERATIONAL FACTORS AND INCIDENTS EFFECTING FLOW RATE

1/2/87, V-101 down 55 min. to back flush.

1/16/87, V-102 down 2 hrs 15 min. back flush and pulsed 3200 lbs of carbon. Row 1 off 3.5 hrs. Row-2 off 20 min. W-7 pump failed. Found tripped out 1/14. W-7 changed 1/16 on line 1600 hrs.

1/30/87, level controller shot on W-31 changed out.

2/6/87, pulsed V-101 with 3200 lbs of carbon, down 2 hrs 55 min.

2/13/87, pulsed V-102 with 3200 lbs of carbon and back flushed. Down 1 hr 30 min.

2/27/87, W-8 flow controller adjusted. Pump checked OK.

3/6/87, pulsed V-102 with 3200 lbs of carbon down 2 hrs 55 min. W-2 electrical points burnt. Howard Electric replaced. W-1 min. meter stuck for 2 days, pump checked OK. Meter replaced.

3/13/87, V-102 down 3 hrs 25 min. Pulsed with 3200 lbs of carbon. Pulled septa screen upstream of vaccum breaker and repaired. Overhauled vac breaker. Also back flushed due to high Δ-P on bed.

3/20/87, north end of Row 1 off for 1 hr 30 min. due to unloading of 20,000 lbs new carbon and plugging of prefilters.

3/27/87, W-2 level control stuck off position - repaired.

4/3/87, V-101 down 3 hrs pulsed 3200 lbs of carbon. W-2 breaker off over weekend, also caused check valve to freeze and break. Repaired and replaced. W-34, 35, 37 and 38 was started up 4/1/87.

4/10/87, V-102 down 3 hrs 20 min. Totalizer meter replaced. New vac breaker installed.

4/16/87, V-101 down 5 hrs. 40 min. Replaced all four septa screens. Cut off bent-sample probe guide. W-7 off due to high bed Δ-P V-102. Could not back flush as septa screens bad. New on order.

4/24/87, W-6 and W-24 turned off 4/20 to lower total flow to below 1500 gpm.

5/1/87, W-6 turned back on to maintain total flow.

5/8/87, down 4 hrs 30 min. V-102 all 4-septa screens replaced. Pulsed with 3200 lbs of carbon. W-7 back, on W-24 remains off to maintain 1500 gpm.

5/15/87, W-6 min. meter stuck on pump OK. Meter replaced. W-2 level control sticking - repaired.

5/22/87, W-24 back on 5/19/87 - all wells on. Total flow down this week.

5/29/87, W-20 motor and pump replaced 5/26. W-29 had pump and motor replaced on 6/2/87.

6/5/87, total RMA power outage down 1-1/2 hrs on 5/30 and 10 min. on 6/4.

6/12/87, V-101 down 2 hrs 45 min. Pulsed with 3200 lbs of carbon. New total flow meter installed.

6/19/87, V-102 down 1 hr 15 min. Pulsed 3200 lbs of carbon. W-34 block valve changed out as gate was off stem.

6/26/87, south end of West Row off 3 hrs 30 min. W-34 had a broken union and had to lower system to change out. W-16 off at breaker reset.

7/3/87, south half of East Row down 3 hrs 30 min. to replace broken fitting on W-37.

7/10/87, W-9 - replaced check valve.

7/17/87, V-102 down 2 hrs 20 min. Pulsed 3200 lbs of carbon. Change out total flow meter. W-2 min. meter replaced.

7/24/87, unloaded 20,000 lbs of carbon. West Row off 2 hrs 26 min due to plugged filters.

7/31/87, new pump and motor installed at W-16.

8/7/87, W-21 off. Reset breaker. W-31 pump replaced along with new union. Pulse V-101 3200 lbs of carbon. Down for 1 hr 30 min.

8/14/87, new pump and motor installed in W-12 on 8/12.

8/21/87, V-102 sump pump replaced. Down for 2 hrs 30 min.

8/28/87, V-102 down 45 min. Pulsed 3200 lbs of carbon.

9/4/87, W-4 new level control installed.

9/12/87, unit shut down to tie in power which was switched from RMA loop to public service direct loop to Plant. Unit down 6 hrs. Also cleaned the main sump, installed new RVS on both adsorbers and two new butterfly valves during downtime.

9/17/87, V-101 down 1 hr 50 min. Pulsed with 2900 lbs of carbon.

9/5/87, W-5 found off. Reset breaker.

10/1/87, W-5 new pump and motor installed.

10/9/87, V-102 down for 1 hr 8 min. Pulsed 3200 lbs of carbon.

11/11/87, W-18 new pump and motor installed. W-37 replaced burnt points in breaker control. V-101 down 3 hrs 35 min. Pulsed 3200 lbs of carbon.

V-102 down 2 hrs 20 min. Pulsed 3200 lbs of carbon. Repaired leaks on inlet elbows and septa screen inlet. Cut off top sample probe guide.

11/24/87, unloaded 20,000 lbs of virgin carbon. Installed new total flow meter V-101. Reset breaker W-31.

11/27/87, W-37 min. meter installed. V-101 down 45 min. Pulsed 2500 lbs of carbon.

12/4/87, shut off W-34, 35, 37 and 38 on 12/1/87 until 4/1/88. V-102 shut down due to cracked and leaking PVC outlet elbows. Replaced with 4-4" 304 S.S. elbows. Downtime 3 hrs 45 min.

12/11/87, V-101 down for sump pump replacement of spare - 3 hrs 10 min. Replaced min. meter W-6.

12/28/87, W-31 level float stuck in on position - repaired.

"1988" OPERATION FACTORS AND INCIDENTS EFFECTING FLOW RATE - (WEEK ENDING DATES)

1/8/88, W-25 - breaker points replaced in controller. Reset breaker W-1.

1/15/88, V-101, sump pump down 1 hr 30 min to replace top bearing. V-102 down 2 hrs 48 min. to pulse with 3200 lbs of carbon.

1/29/88, W-16 shut down 3 hrs due to broken line to main header. SE Row 2 hrs 40 min to repair broken header from W-16. On 1/25/88, V-101 shut down to install new sump pump 3 hrs 30 min. N. and center of West Row - off 3 hrs 5 min.

2/5/88, W-10 off at breaker reset.

2/12/88, W-10 new motor installed - V-102 down for 1 hr 45 min. to pulse 3200 lbs of carbon.

2/19/88, V-101 down 2 hrs 45 min to pulse 3200 lbs of carbon. North end West Row off.

2/26/88, W-12 new pump and motor installed.

4/1/88, both V-101 and V-102 down for 30 min. to back flush due to high Δ-P. On 3/30/88, shut down 7 hrs 20 min. to pulse with 3200 lbs of carbon. Had to replace broken PVC elbow. Installed four new 304SS elbows. Replaced 2-septa screens. Replaced vaccum breaker. Cut off bent probe guide center 2.5. Turn on W-34, 35, 37 and 38.

4/8/88, W-2 off at breaker reset.

4/15/88, W-1 level control repaired. W-24, shut off to maintain total flow under 1500 gpm.

4/22/88, V-101 and V-102 down. V-102 sump bearing out V-101 put back on line with West Row off. V-101 downtime 36 min. V-102 down 14 hrs 30 min along with West Row for sump pump replacement.

4/29/88, V-101 and V-102 down to replace relined pre and post filter cases and pull another for relining. V-101 down for 3 hrs 15 min. V-102 down 2 hrs 30 min.

5/13/88, bad leak on bottom of V-101. 1/4" hole found corroded through at weld seam junction on inlet flange and bottom dished head. A wooden plug was driven in to plug leak.

5/20/88, decision made to buy a new vessel and install. H.O. project approved. W-1 breaker off. Reset OK.

5/27/88, installed all new contacts in W-1 motor control center.

6/3/88, V-102 down for 3 hrs 45 min. to install new sump pump.

6/10/88, V-101 down 15 min. to back flush. V-101 down 2 hrs 10 min. to pulse with 3200 lbs of carbon.

6/17/88, V-101 down 1 hr 30 min. to install new 2" valve for fill line.

6/24/88, V-101 down 45 min to back flush.

7/1/88, shut down V-101 to install new crossover piping for new vessel V-103. Had to allow 48 hrs for P.V.C. glue to cure. Total downtime 51 hrs 10 min.

7/8/88, V-102 down 96 hrs to install new cross over piping for new vessel V-103. Leaks on hydro test. Had to allow an additional 48 hrs for PVC glue to cure. West Row also down during this period for 96 hrs. W-6 & W-7 left off to control flow under 1500 gpm. W-6 back on 7/6 and W-7 back on 7/7.

7/8/88, V-103 put into service this date.

7/8/88, V-101 shut down. Will empty and prepare for internal inspection.

7/8/88, W-7 had new pump and motor installed.

7/22/88, W-4 new pump and motor installed.

8/5/88, West Row off. Bag filter plugging.

8/5/88, V-103 shut down 24 hrs to repair leaks on lines. Allowed 24 hrs to glue to cure.

8/5/88, V-102 down 2 hrs 15 min. to install relined post and pre-filter cases. Also took out four cases to be relined.

8/12/88, V-103 down 24 hrs due to leaks on fitting. Allowed 24 hrs for glue to cure.

8/26/88, V-103 down 15 min. to back flush.

9/16/88, V-102 down 3 hrs 25 min. Installed relined pre and post filter cases and took out two to be relined.

9/23/88, V-102 down 15 min. to back flush. North end of West Row down 1 hr 30 min. for new valve on W-4.

9/30/88, W-5, W-7 off to install new valves.

9/30/88, V-103 down 1 hr 50 min. Installed two relined filter cases.

9/30/88, V-102 down 3 hrs 30 min. pulsed 5500 lbs of carbon. PSC total power failure, 5 seconds duration.

10/3/88, V-102 down 15 min. to back flush.

10/21/88, W-29 had bad level control - repaired.

10/28/88, PSC. Power failure - caused bag filter plugging. Duration 5 seconds.

11/4/88, PSC total power failure 1 hr 20 min. Power off 3-times from 2420 to 0330 hrs. V-103 down 1 hr 30 min. and V-102 down 2 hrs due to bag filter plugging also post filters. PSC contacted to investigate problem. W-36 min. meter changed out.

11/15/88, V-102 and West Row down 2 hrs to install two relined filter cases.

12/2/88, V-102 down 20 min. to back flush. V-103 down 15 min for back flush.

12/9/88, V-102 down 1 hr 15 min. to pulse 3200 lbs of carbon. V-102 down 3 hrs 10 min. to try and replace top bearing on sump. Did not help as center bear is bad.

12/16/88, V-103 down 1 hr 30 min. to pulse 3200 lbs of carbon. New pump installed on W-1.

APPENDIX B
DBCP DATA

IRONDALE DBCP CONTROL SYSTEM -
GROUNDWATER QUALITY MONITORING DATA

I. CONTROL SYSTEM

A. Adsorbers

	DBCP, PPB							
	V - 101				V - 102			
Sample Date	Influent	Middle 1 Foot	Middle 5 Feet	Effluent	Influent	Middle 1 Foot	Middle 5 Feet	Effluent
11/10/86	0.40	---	---	BDL	0.36	---	---	BDL
11/24/86	0.34	BDL	BDL	BDL	0.28	BDL	P	BDL
12/08/86	P	---	---	BDL	P	---	---	BDL
12/22/86	0.38	BDL	0.22	BDL	0.34	BDL	BDL	BDL
01/05/87	0.37	---	---	BDL	0.32	---	---	BDL
01/19/87	0.38	BDL	P	BDL	0.32	P	BDL	BDL
02/09/87	0.43	---	---	BDL	0.39	---	---	BDL

B. Extraction Wells -

Date Sampled	Well ID	DBCP, PPB	Date Sampled	Well ID	DBCP, PPB
01/14/87	W-2	0.33	01/13/87	W-16	2.67
01/14/87	W-4	BDL	01/13/87	W-18	0.71
01/14/87	W-8	P	01/13/87	W-20	0.22
01/14/87	W-10	BDL	01/13/87	W-25	1.33
01/14/87	W-12	BDL	01/13/87	W-27	1.28
01/13/87	W-14	BDL	01/13/87	W-29	0.25
01/13/87	W-33	BDL	01/13/87	W-31	BDL
01/13/87	W-35	BDL	01/13/87	W-36	BDL
			01/13/87	W-38	BDL

NOTE: BDL = Below detection limit of 0.06 PPB
P = Indicates presence of DBCP between 0.06 PPB limit of detectability and 0.20 PPB limit of determinability

IRONDALE DBCP CONTROL SYSTEM -
GROUNDWATER QUALITY MONITORING DATA

I. CONTROL SYSTEM

A. Adsorbers

DBCP, PPB

Sample Date	V - 101 Influent	V - 101 Middle 1-3 Feet	V - 101 Middle 5 Feet	V - 101 Effluent	V - 102 Influent	V - 102 Middle 1-3 Feet	V - 102 Middle 5 Feet	V - 102 Effluent
02/23/87	0.34	P	P	BDL	0.33	P	P	BDL
03/09/87	0.33	---	---	BDL	0.29	---	---	BDL
03/23/87	0.32	BDL	BDL	BDL	0.30	BDL	P	BDL
04/13/87	0.32	P	BDL	BDL	0.26	---	---	BDL
04/27/87	0.31	P	BDL	BDL	0.28	P	P	BDL

B. Extraction Wells -

Date Sampled	Well ID	DBCP, PPB	Date Sampled	Well ID	DBCP, PPB
04/14/87	W-2	P	04/14/87	W-16	2.26
04/14/87	W-4	BDL	04/14/87	W-18	0.66
04/14/87	W-8	BDL	04/14/87	W-20	P
04/14/87	W-10	BDL	04/13/87	W-25	0.85
04/14/87	W-12	BDL	04/13/87	W-27	0.83
04/14/87	W-14	BDL	04/13/87	W-29	0.20
04/14/87	W-33	BDL	04/13/87	W-31	BDL
04/14/87	W-35	BDL	04/13/87	W-36	BDL
			04/13/87	W-38	BDL

NOTE: BDL = Below detection limit of 0.06 PPB
P = Indicates presence of DBCP between 0.06 PPB limit of detectability and 0.20 PPB limit of determinability

IRONDALE DBCP CONTROL SYSTEM
GROUNDWATER QUALITY MONITORING DATA

I. CONTROL SYSTEM

A. Adsorbers

Sample Date	DBCP, ppb			
	V-101		V-102	
	Influent	Effluent	Influent	Effluent
5-11-87	0.28	BDL	0.16	BDL
5-26-87	0.26	BDL	0.21	BDL
6-08-87	0.28	BDL	0.19	BDL
6-22-87	0.38	BDL	0.38	BDL
7-13-87	0.27	BDL	0.24	BDL
7-27-87	0.28	BDL	0.29	BDL

B. Extraction Wells

Date Sampled	Well ID	DBCP, ppb	Date Sampled	Well ID	DBCP, ppb
7-13-87	W-2	P	7-13-87	W-25	1.21
7-13-87	W-4	BDL	7-13-87	W-27	0.66
7-13-87	W-6	BDL	7-13-87	W-29	0.52
7-13-87	W-10	BDL	7-13-87	W-31	P
7-13-87	W-12	BDL	7-13-87	W-33	BDL
7-13-87	W-14	BDL	7-13-87	W-35	BDL
7-13-87	W-16	1.75	7-13-87	W-36	BDL
7-13-87	W-18	0.48	7-13-87	W-38	BDL
7-13-87	W-20	P			

NOTE: BDL = Below detection limit of 0.06 ppb.
P = Indicates presence of DBCP between 0.06 ppb limit of detectability and 0.20 ppb limit of determinability.

IRONDALE DBCP CONTROL SYSTEM
GROUNDWATER QUALITY MONITORING DATA

I. CONTROL SYSTEM

A. Adsorbers

Sample Date	DBCP, ppb V-101 Influent	V-101 Effluent	V-102 Influent	V-102 Effluent
8-10-87	0.33	BDL	0.27	BDL
8-24-87	0.30	BDL	0.30	BDL
9-14-87	0.41	BDL	0.37	BDL
10-2-87	0.41	BDL	0.35	BDL
10-12-87	0.43	BDL	0.38	BDL

B. Extraction Wells

Date Sampled	Well ID	DBCP, ppb	Date Sampled	Well ID	DBCP, ppb
10-14-87	W-2	P	10-14-87	W-25	2.79
10-14-87	W-4	BDL	10-14-87	W-27	1.00
			10-14-87	W-29	2.00
10-14-87	W-10	BDL	10-14-87	W-31	1.71
10-14-87	W-12	P	10-14-87	W-33	BDL
10-14-87	W-14	BDL	10-14-87	W-35	BDL
10-14-87	W-16	1.55	10-14-87	W-36	0.67
10-14-87	W-18	0.64	10-14-87	W-38	BDL
10-14-87	W-20	P			

NOTE: BDL = Below detection limit of 0.06 ppb.
P = Indicates presence of DBCP between 0.06 ppb limit of detectability and 0.20 ppb limit of determinability.

IRONDALE DBCP CONTROL SYSTEM
GROUNDWATER QUALITY MONITORING DATA

I. CONTROL SYSTEM

A. Adsorbers

Sample Date	DBCP, ppb			
	V-101		V-102	
	Influent	Effluent	Influent	Effluent
10-26-87	0.41	BDL	0.33	BDL
11-09-87	0.33	BDL	0.36	BDL
11-23-87	0.34	BDL	0.30	BDL
12-07-87	0.41	BDL	0.34	BDL
12-21-87	0.34	BDL	0.34	BDL
01-04-88	0.32	BDL	0.32	BDL
01-18-88	0.42	BDL	0.30	BDL
02-01-88	0.32	BDL	0.32	BDL

	TCE, ppb	
	V-101, Influent	V-102, Influent
01-11-88	BDL	BDL

B. Extraction Wells

Date Sampled	Well ID	DBCP, ppb	Date Sampled	Well ID	DBCP, ppb
01-11-88	W-2	P	01-11-88	W-25	2.2
01-11-88	W-4	BDL	01-11-88	W-27	1.3
01-11-88	W-8	P	01-11-88	W-29	1.2
01-11-88	W-10	BDL	01-11-88	W-31	0.31
01-11-88	W-12	P	01-11-88	W-33	BDL
01-11-88	W-14	BDL	01-11-88	W-35	BDL
01-11-88	W-16	1.0	01-11-88	W-36	BDL
01-11-88	W-18	0.42	01-11-88	W-38	BDL
01-11-88	W-20	P			

NOTE: BDL = Below detection limit of 0.06 ppb DBCP; 1.0 ppb TCE.
P = Indicates presence of DBCP between 0.06 ppb limit of detectability and 0.20 ppb limit of determinability.

IRONDALE DBCP CONTROL SYSTEM
GROUNDWATER QUALITY MONITORING DATA

I. CONTROL SYSTEM

A. Adsorbers

Sample Date	DBCP, ppb V-101 Influent	V-101 Effluent	V-102 Influent	V-102 Effluent
2-15-88	0.38	BDL	0.32	BDL
2-29-88	0.33	BDL	0.32	BDL
3-14-88	0.34	BDL	0.23	BDL
3-28-88	0.35	BDL	0.32	BDL
4-11-88	0.29	BDL	0.26	BDL
4-25-88	0.33	BDL	0.21	BDL
5-09-88	0.30	BDL	0.20	BDL
5-23-88	0.24	BDL	0.25	BDL

	TCE, ppb V-101, Influent	V-102, Influent
4-11-88	BDL	BDL

B. Extraction Wells

Date Sampled	Well ID	DBCP, ppb	Date Sampled	Well ID	DBCP, ppb
4-11-88	W-2	0.12	4-11-88	W-25	1.4
4-11-88	W-4	0.06	4-11-88	W-27	1.3
4-11-88	W-8	BDL	4-11-88	W-29	0.49
4-11-88	W-10	BDL	4-11-88	W-31	0.08
4-12-88	W-12	BDL	4-12-88	W-33	BDL
4-12-88	W-14	BDL	4-12-88	W-35	BDL
4-11-88	W-16	1.4	4-12-88	W-36	BDL
4-11-88	W-18	0.35	4-12-88	W-38	BDL
4-11-88	W-20	0.09			

NOTE: BDL = Below detection limit of 0.06 ppb DBCP; 1.0 ppb TCE.
P = Indicates presence of DBCP between 0.06 ppb limit of detectability and 0.20 ppb limit of determinability.

IRONDALE DBCP CONTROL SYSTEM
GROUNDWATER QUALITY MONITORING DATA

I. CONTROL SYSTEM

A. Adsorbers

Sample Date	DBCP, ppb			
	V-101/103		V-102	
	Influent	Effluent	Influent	Effluent
6-06-88	0.28	BDL	0.22	BDL
6-20-88	0.28	BDL	0.25	BDL
7-05-88	0.41	BDL		
7-11-88	0.24	BDL		
7-18-88	0.20	BDL	P	BDL
8-01-88	0.29	BDL	0.24	BDL
8-15-88	0.31	BDL	0.27	BDL
8-29-99	0.30	BDL	0.28	BDL

	TCE, ppb	
	V-101, Influent	V-102, Influent
7-25-88	BDL	BDL

B. Extraction Wells

Date Sampled	Well ID	DBCP, ppb	Date Sampled	Well ID	DBCP, ppb
7-22-88	W-2	0.20	7-22-88	W-25	2.6
7-22-88	W-4	BDL	7-22-88	W-27	1.1
7-22-88	W-8	BDL	7-22-88	W-29	1.3
7-22-88	W-10	BDL	7-22-88	W-31	0.89
7-22-88	W-12	BDL	7-22-88	W-33	BDL
7-22-88	W-14	BDL	7-22-88	W-35	BDL
7-22-88	W-16	0.72	7-22-88	W-36	0.62
7-22-88	W-18	P	7-22-88	W-38	0.32
7-22-88	W-20	BDL			

NOTE: BDL = Below detection limit of 0.06 ppb DBCP; 1.0 ppb TCE.
P = Indicates presence of DBCP between 0.06 ppb limit of detectability and 0.20 ppb limit of determinability.

IRONDALE DBCP CONTROL SYSTEM
GROUNDWATER QUALITY MONITORING DATA

I. CONTROL SYSTEM

A. Adsorbers

Sample Date	DBCP, ppb			
	V-102		V-103	
	Influent	Effluent	Influent	Effluent
9-12-88	0.34	BDL	0.36	BDL
9-26-88	0.38	P	0.44	BDL
10-10-88	0.38	BDL	0.45	BDL
10-25-88	0.42	BDL	0.40	BDL
11-07-88	0.36	BDL	0.42	BDL
11-21-88	0.37	BDL	0.42	BDL

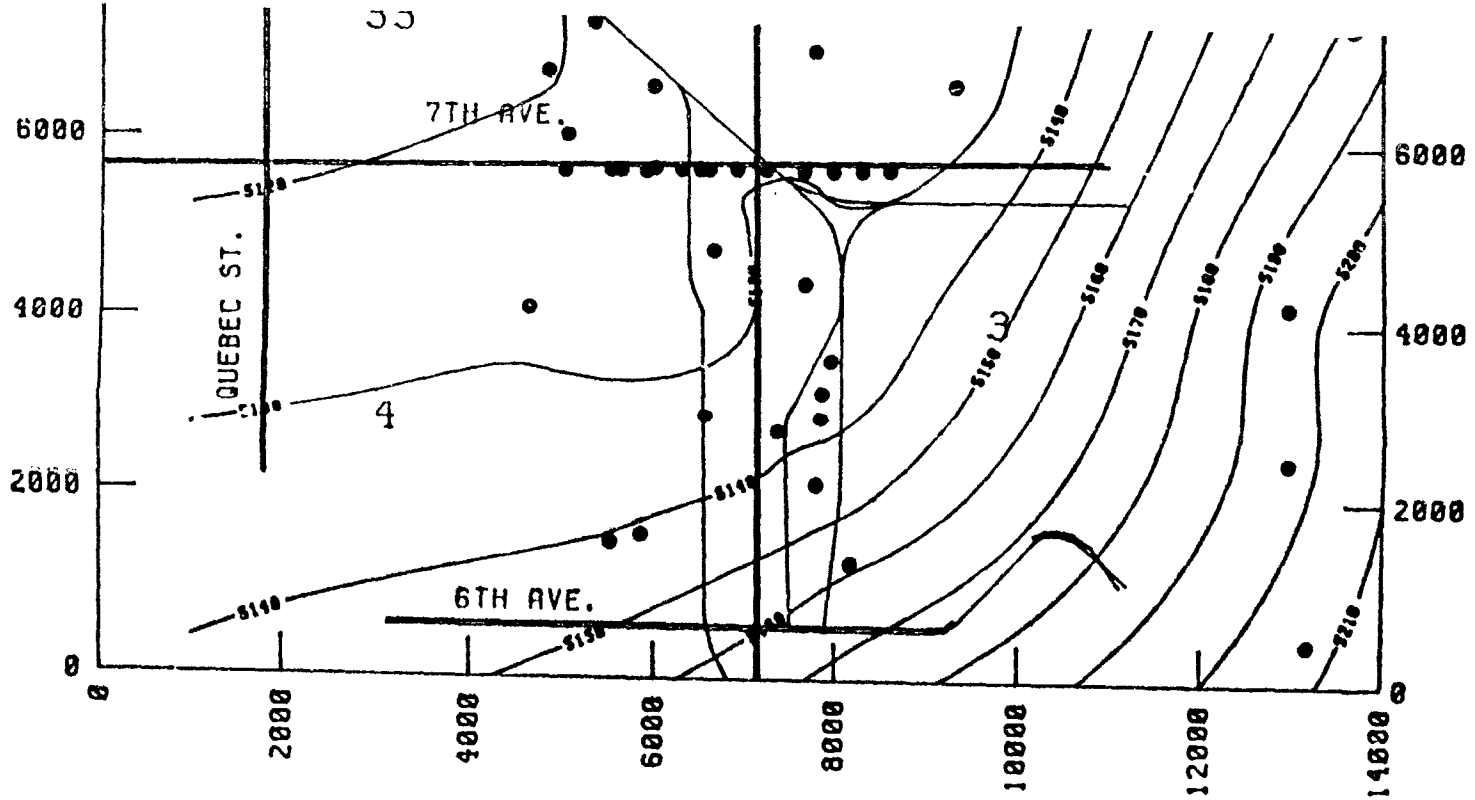
	TCE, ppb			
	V-102		V-103	
	Influent	Effluent	Influent	Effluent
10-12-88	BDL		2	
11-03-88	BDL	BDL	BDL	BDL

B. Extraction Wells

Date Sampled	Well ID	DBCP, ppb	Date Sampled	Well ID	DBCP, ppb
10-12-88	W-2	P	10-12-88	W-25	2.7
10-12-88	W-4	BDL	10-12-88	W-27	0.89
10-12-88	W-8	P	10-12-88	W-29	2.6
10-12-88	W-10	BDL	10-12-88	W-31	2.5
10-12-88	W-12	0.56	10-12-88	W-33	P
10-12-88	W-14	BDL	10-12-88	W-35	BDL
10-12-88	W-16	0.98	10-12-88	W-36	2.1
10-12-88	W-18	0.26	10-12-88	W-38	0.30
10-12-88	W-20	BDL	10-12-88		

NOTE: BDL = Below detection limit of 0.06 ppb DBCP; 1.0 ppb TCE.
P = Indicates presence of DBCP between 0.06 ppb limit of detectability and 0.20 ppb limit of determinability.

APPENDIX C
WATER TABLE CONTOUR MAPS



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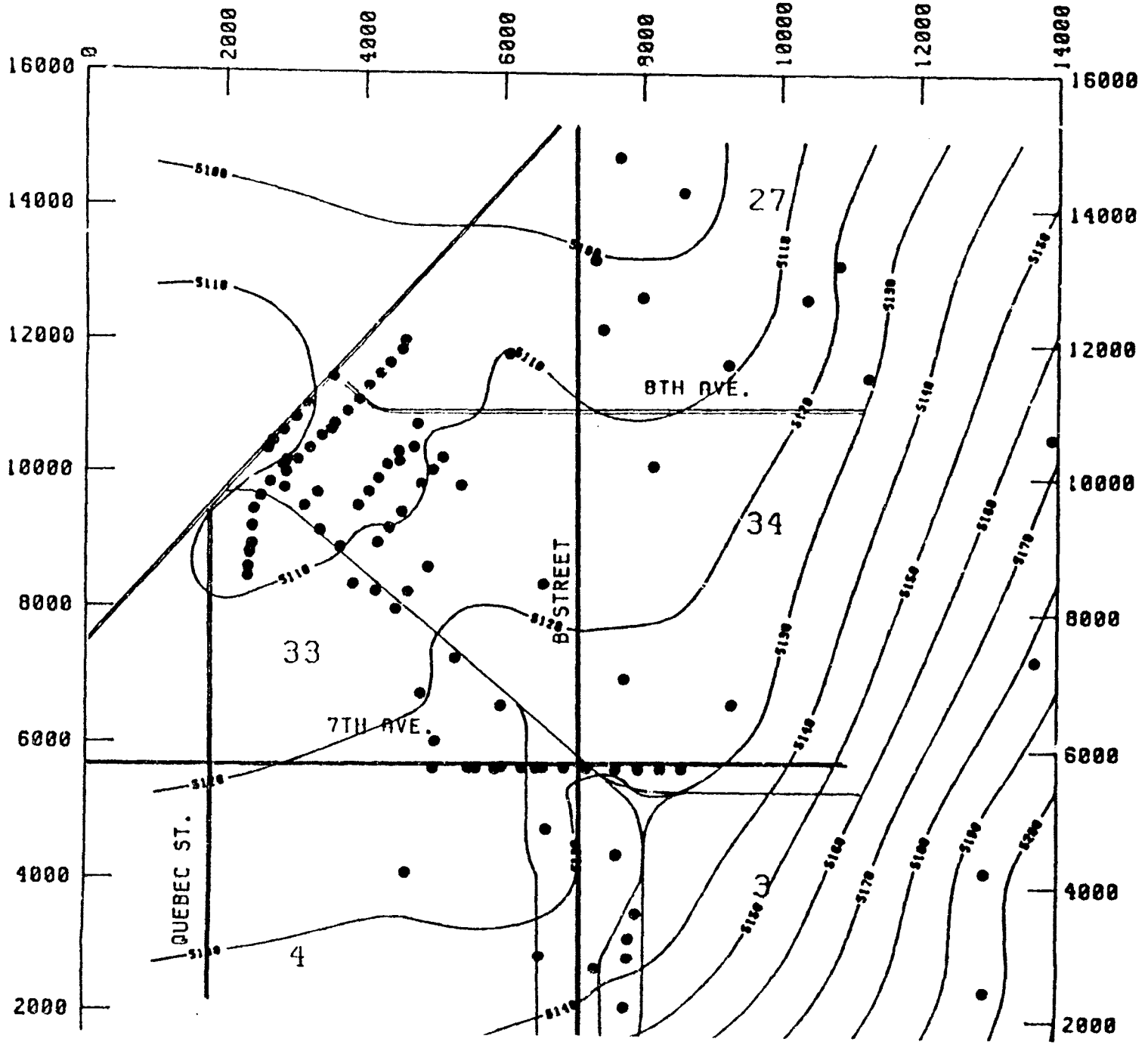
Author:	Date: 6-JAN-1989
Report:	Encl.:
File No:	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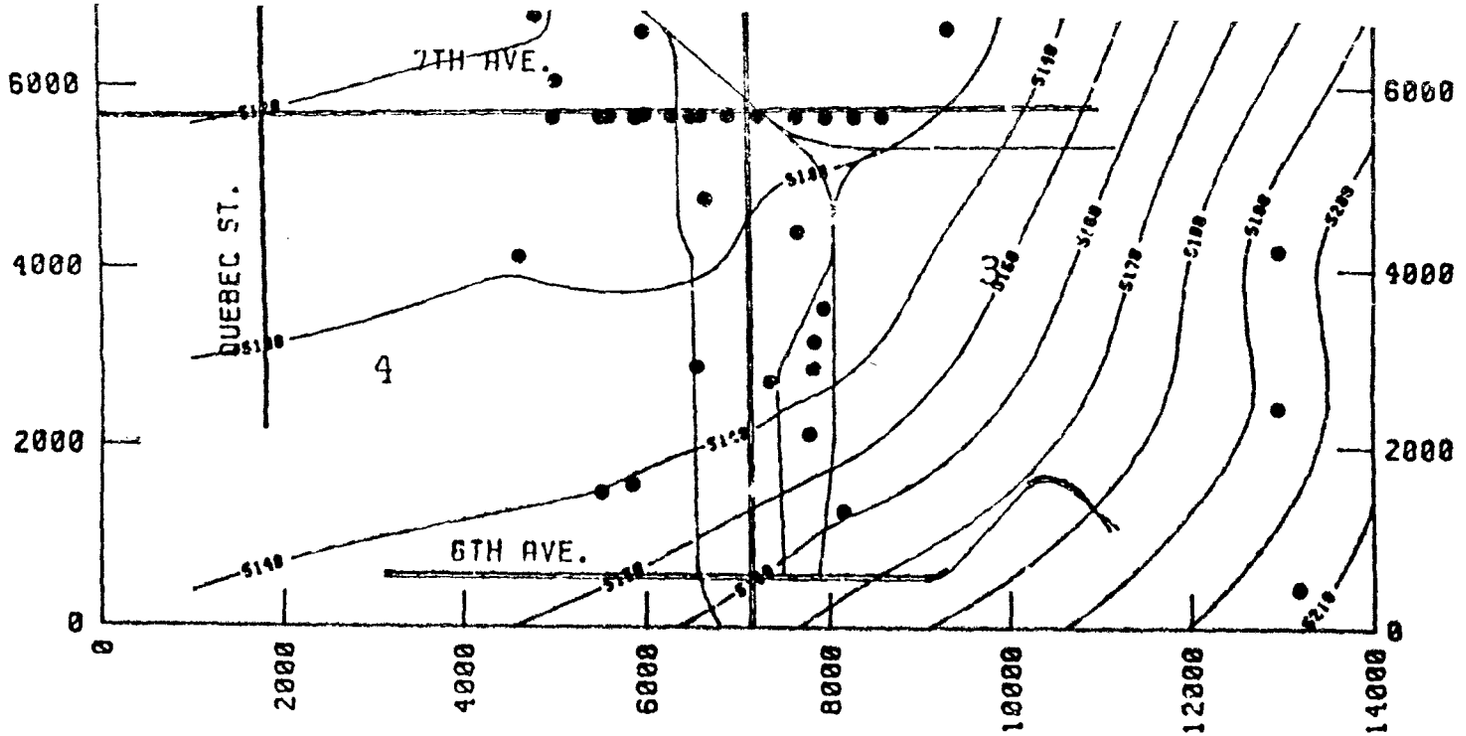
QUEBEC ST.
27
34
33
4
3



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Report:	Encl:
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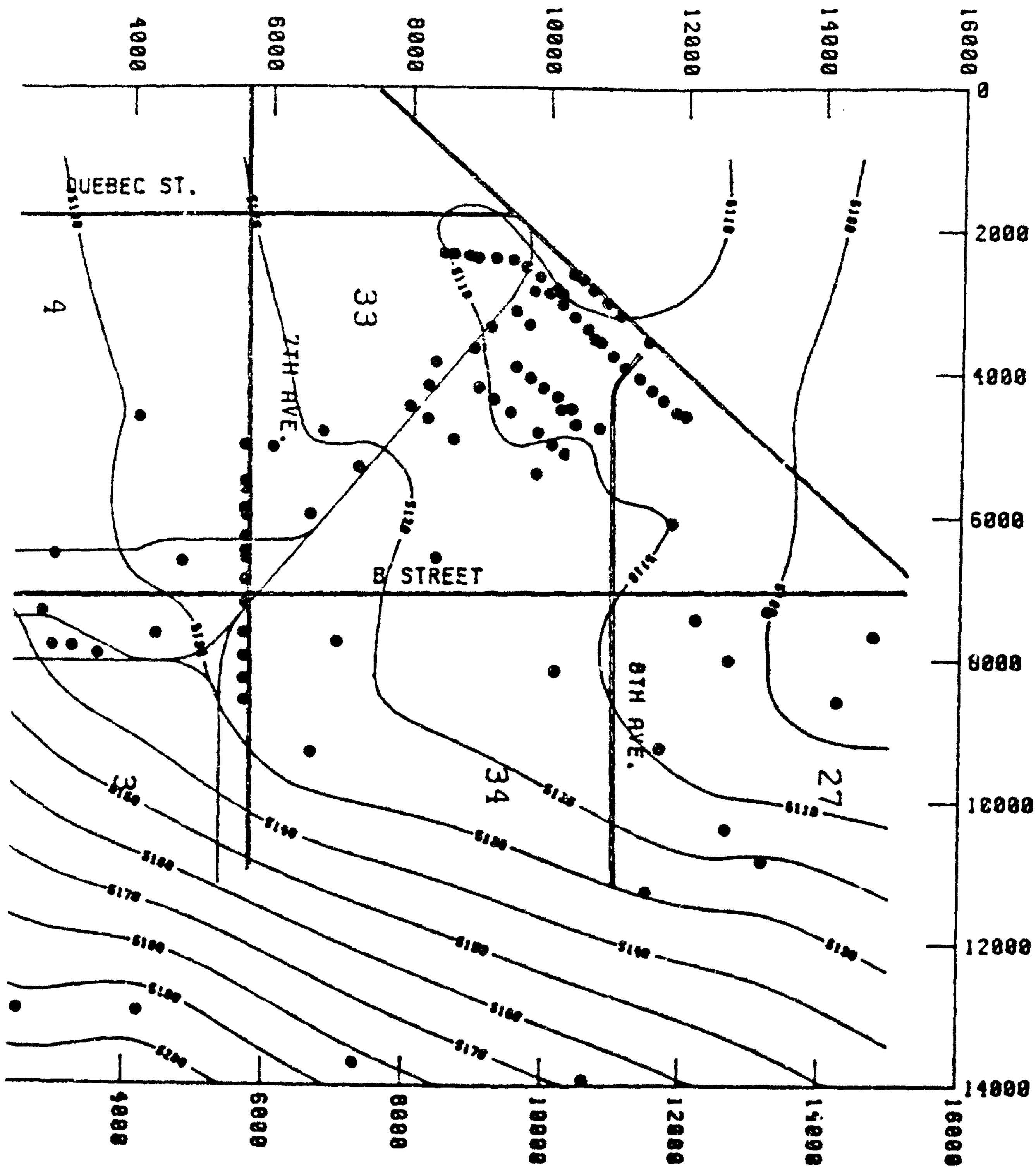
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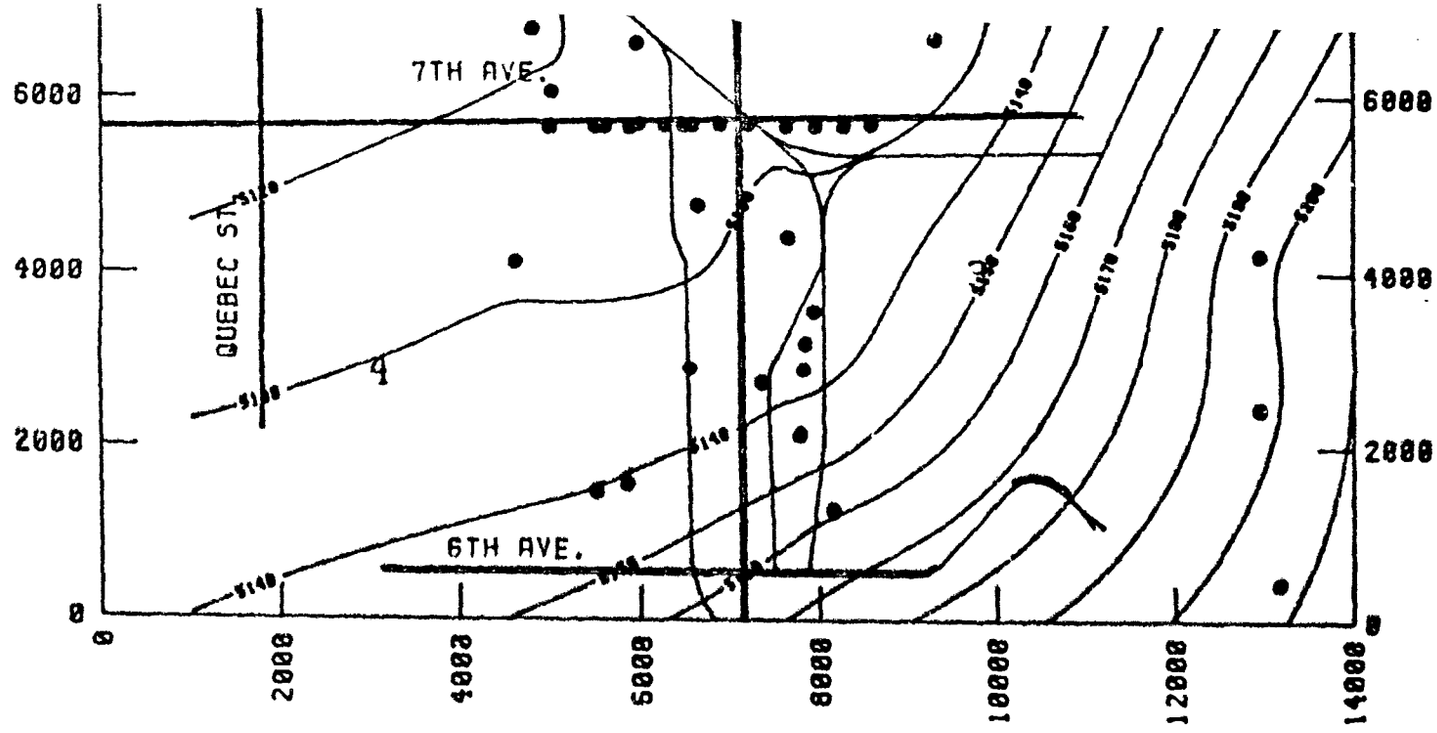

IRONDALE
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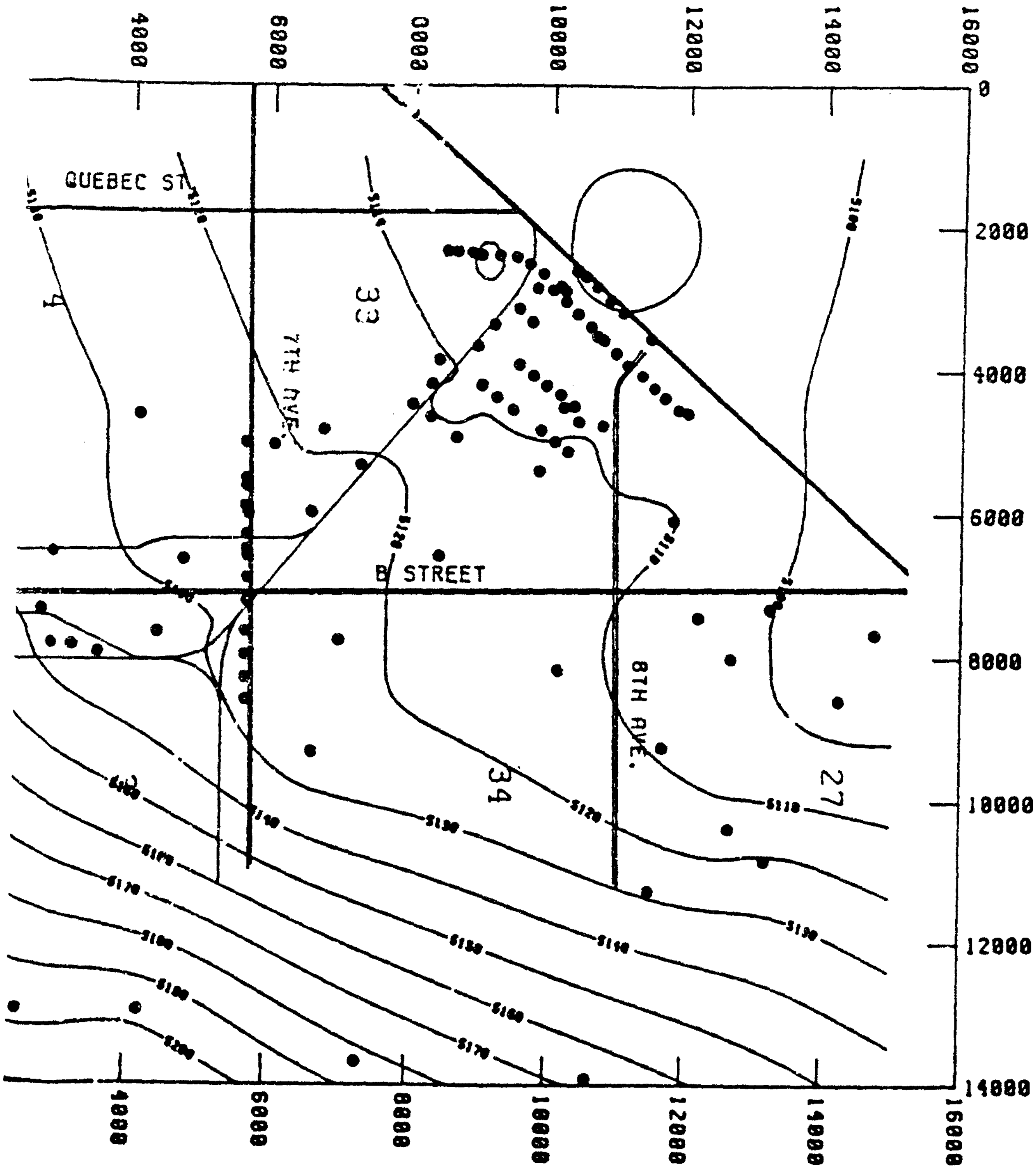

QUEBEC ST
7TH AVE.
B STREET
8TH AVE.
33
34
27
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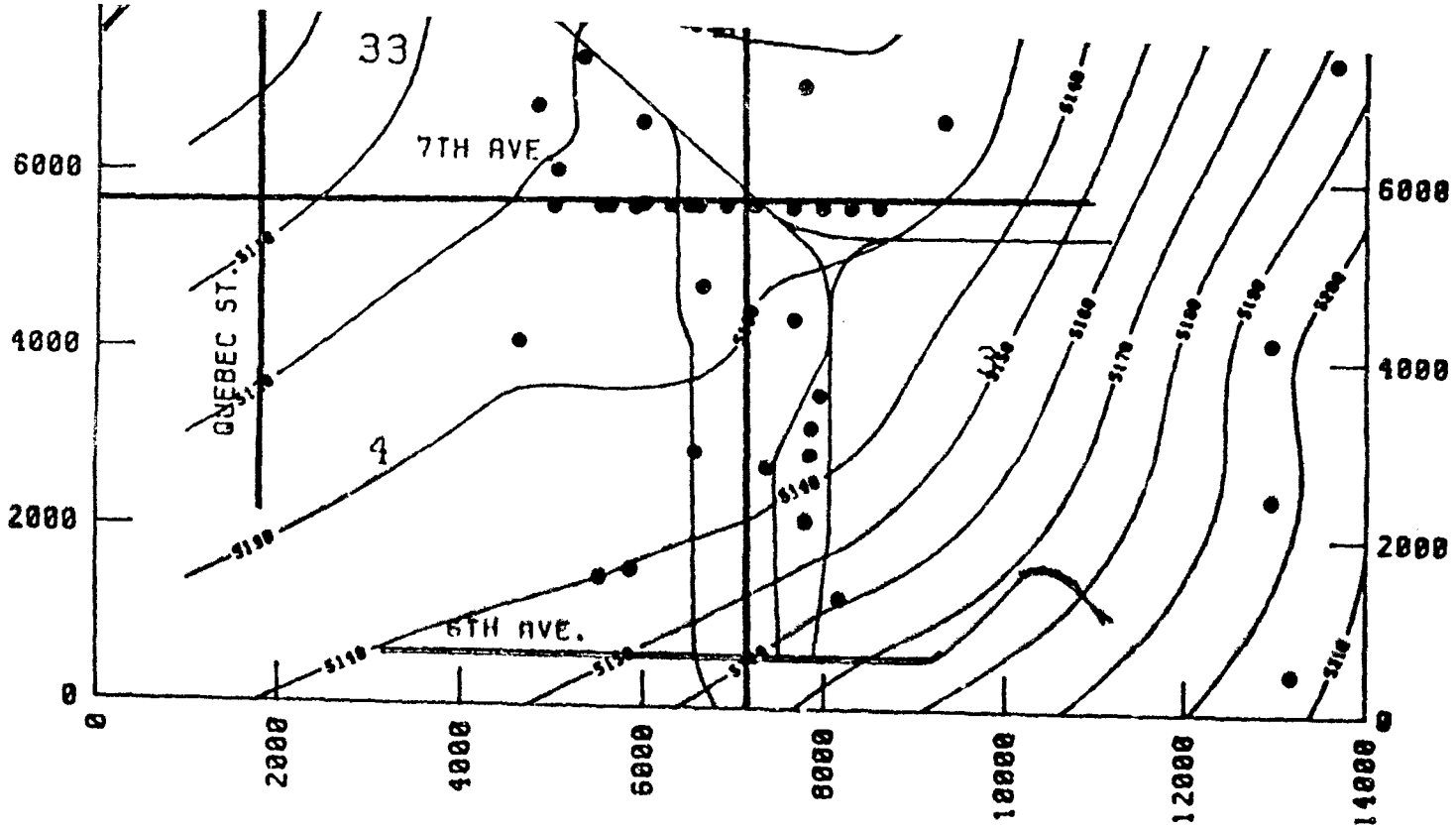

IRONDALE
WATER TABLE ELEVATION 10/87

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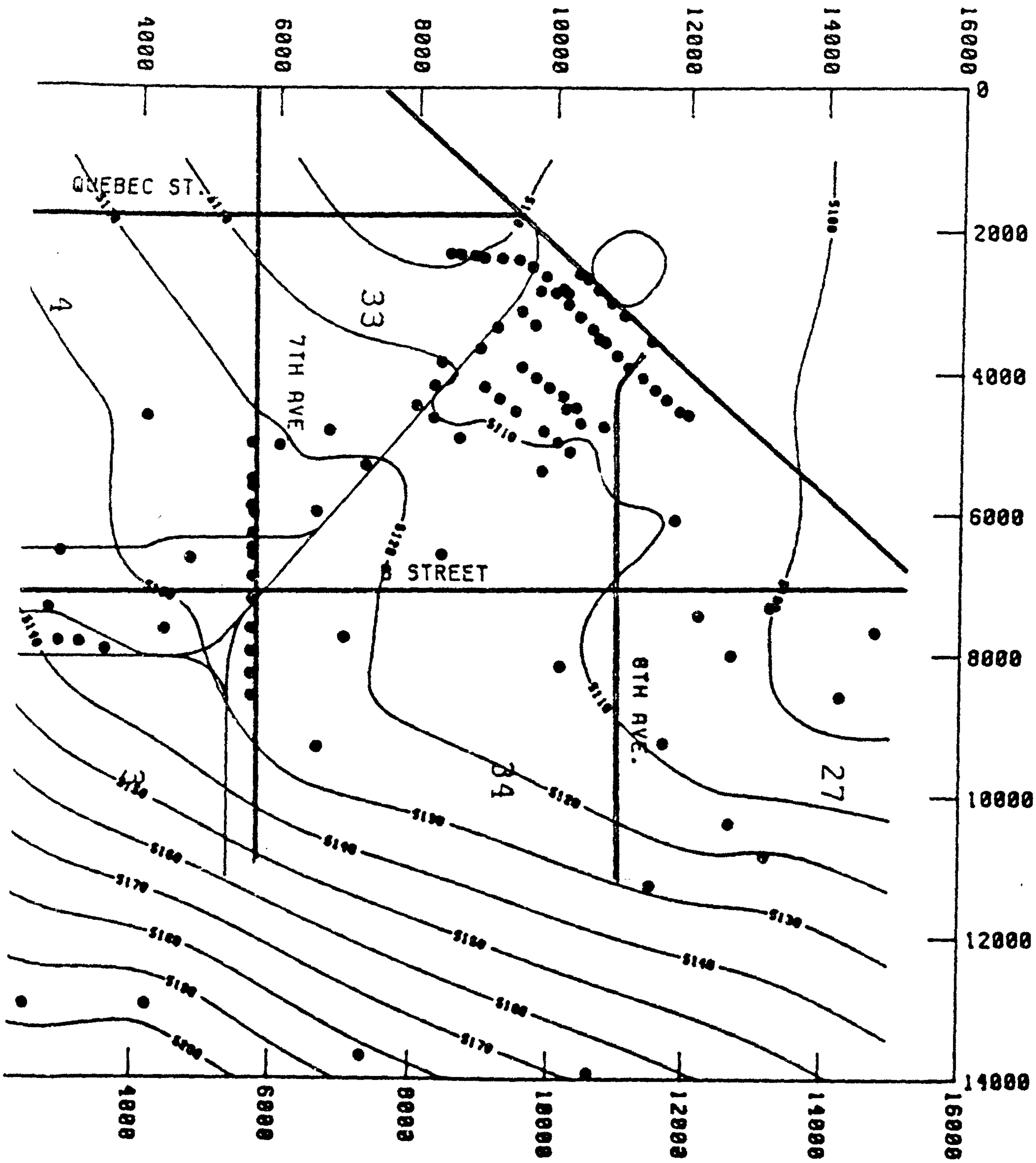
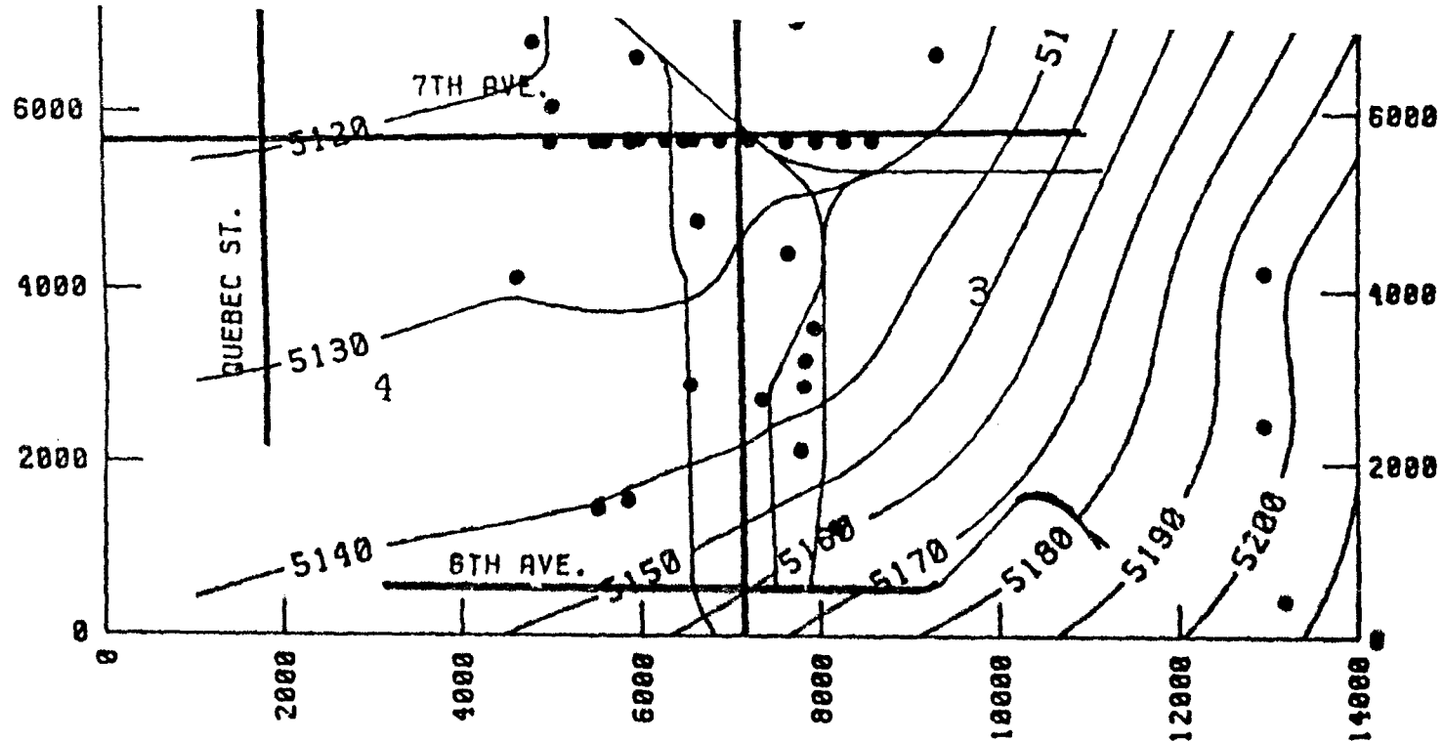
Author:	Date: 8-[illegible]-1988
Report:	Engr:
File No:	



QUEBEC ST.
B STREET
7TH AVE
8TH AVE.
33
34
27
4
3
0
2000
4000
6000
8000
10000
12000
14000
16000



IRONDALE
WATER TABLE ELEVATION 4/88

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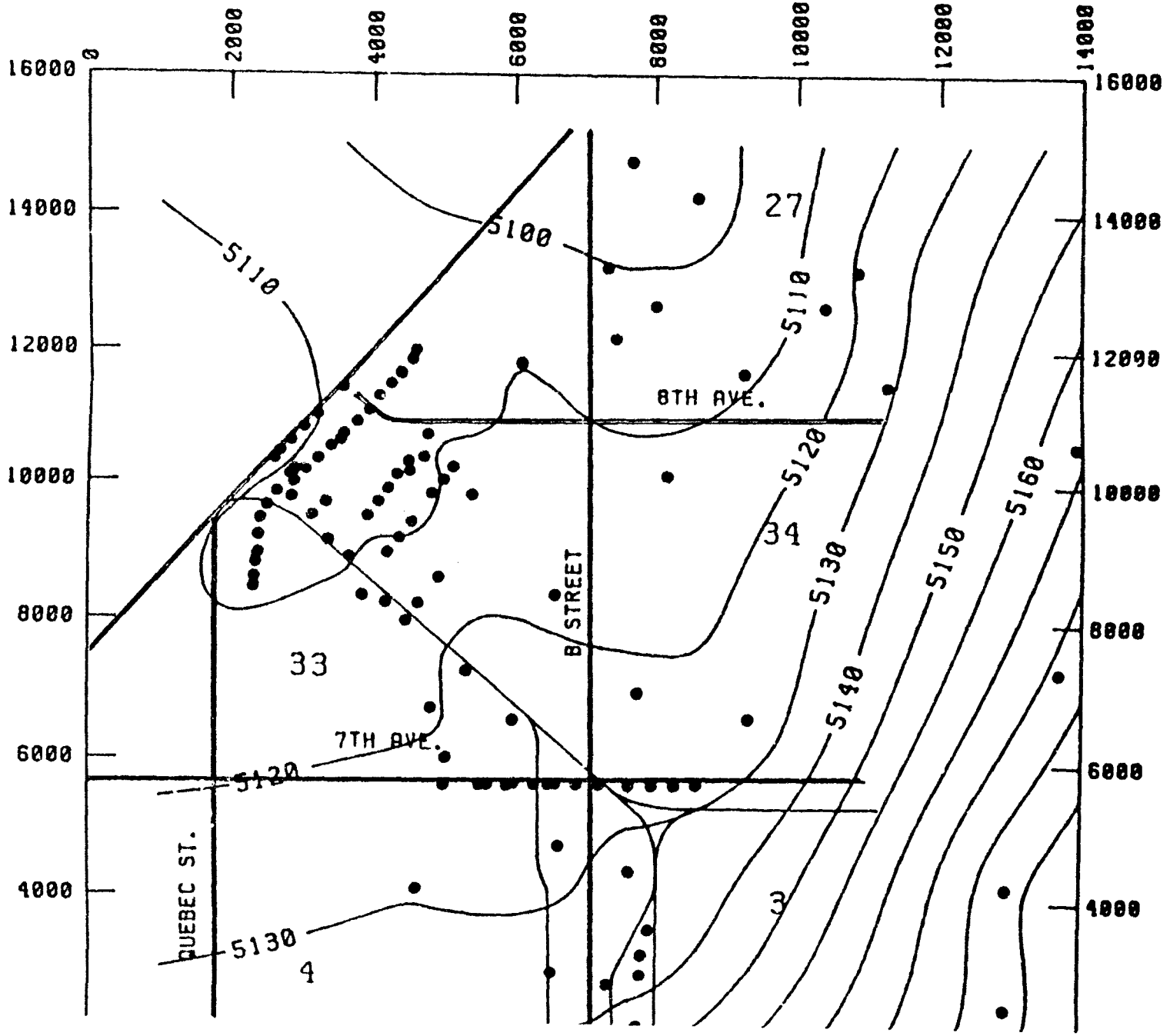
Author:	Date: [illegible]
Report:	Encl.:
File No:	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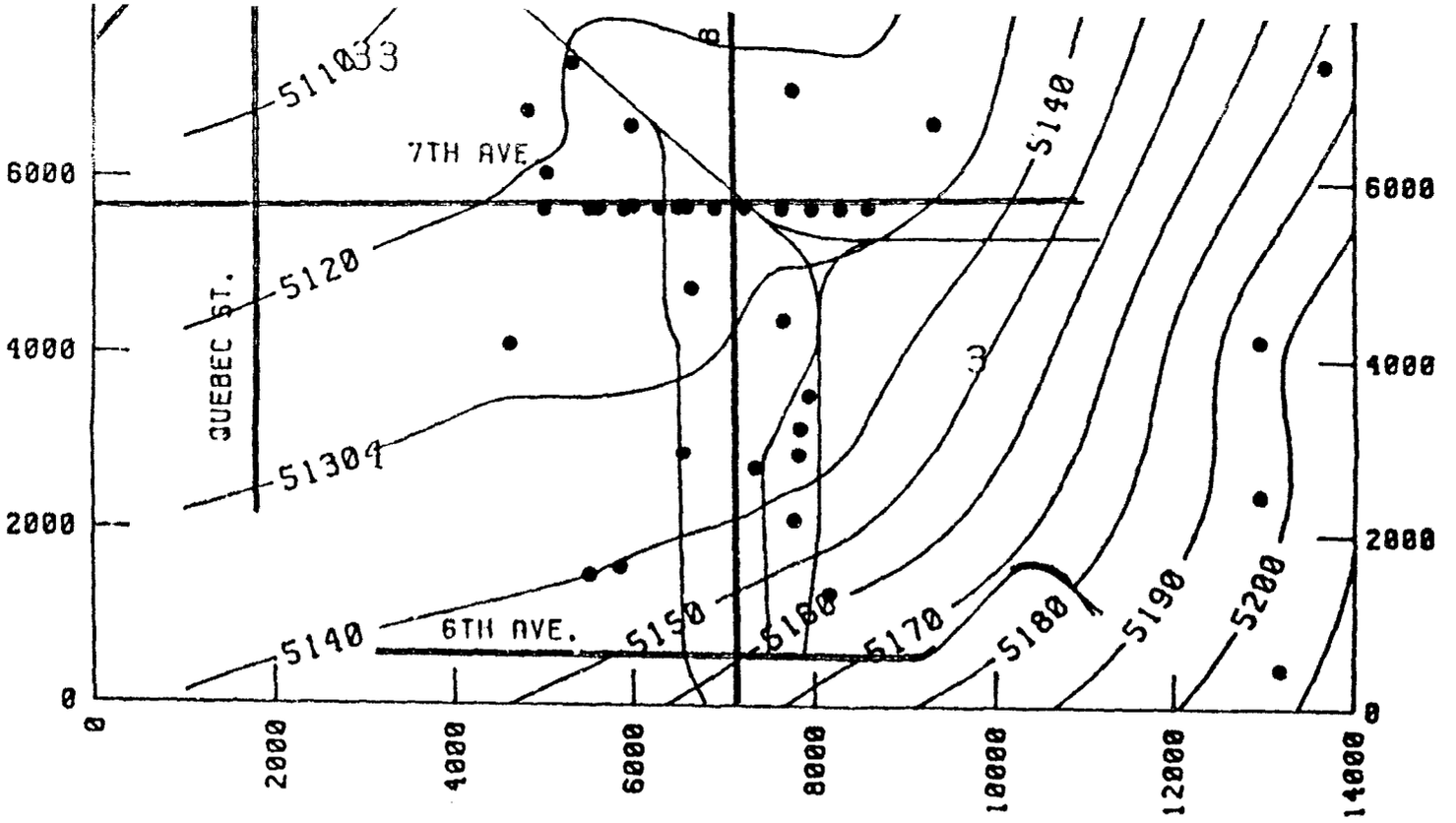
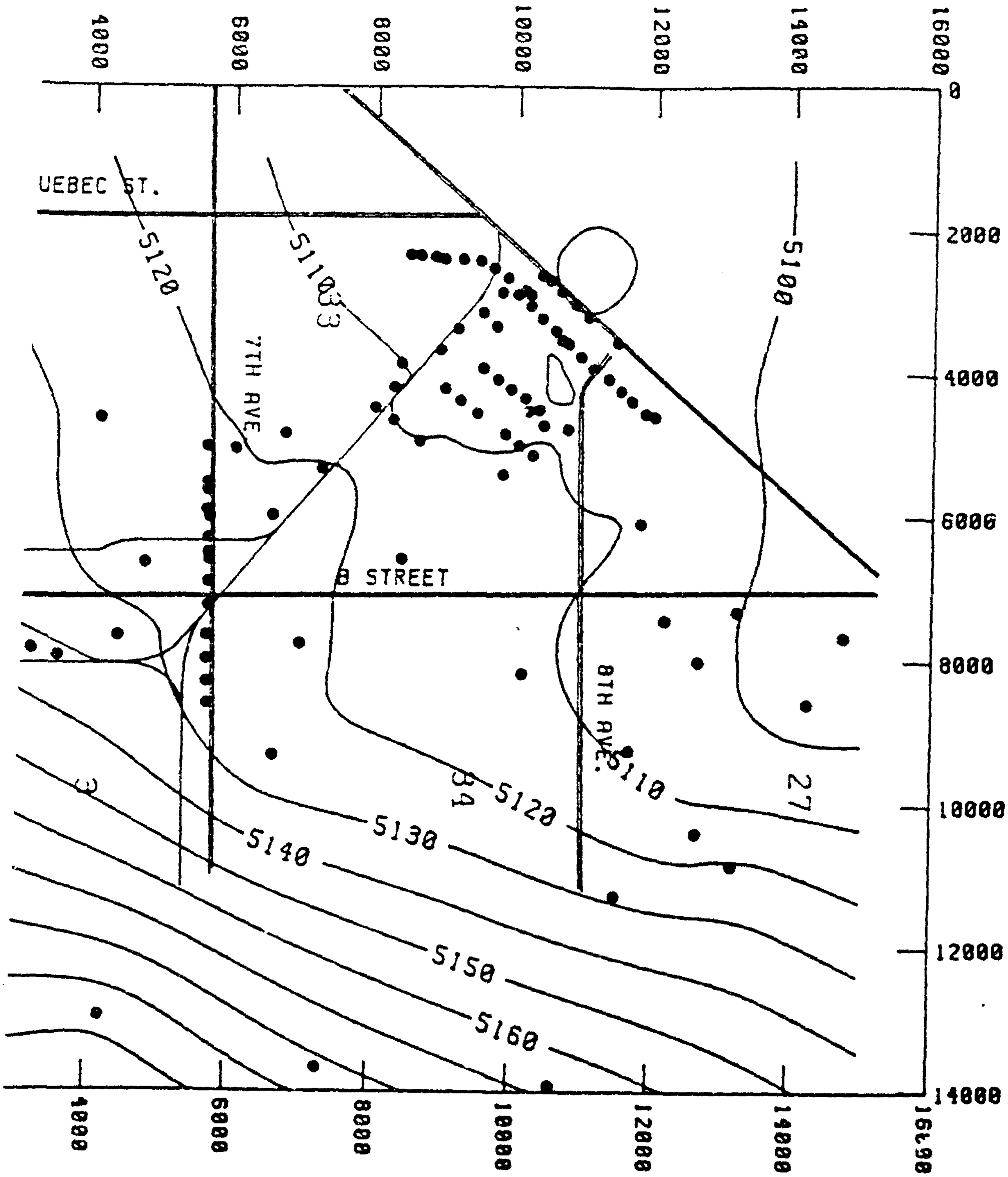
4000
6000
8000
10000
12000
14000
16000
5100
5110
5120
5130
5140
5150
5160
8TH AVE.
7TH AVE.
B STREET
QUEBEC ST.
27
34
33
4
3



IRONDALE
WATER TABLE ELEVATION 10/88

Province/Field:	
County/State: COLORADO	
Author:	Date:
Report:	Encl.:
File No:	


UEBEC ST.
B STREET
7TH AVE
8TH AVE.
5100
5110
5120
5130
5140
5150
5160
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34
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3
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0
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4000
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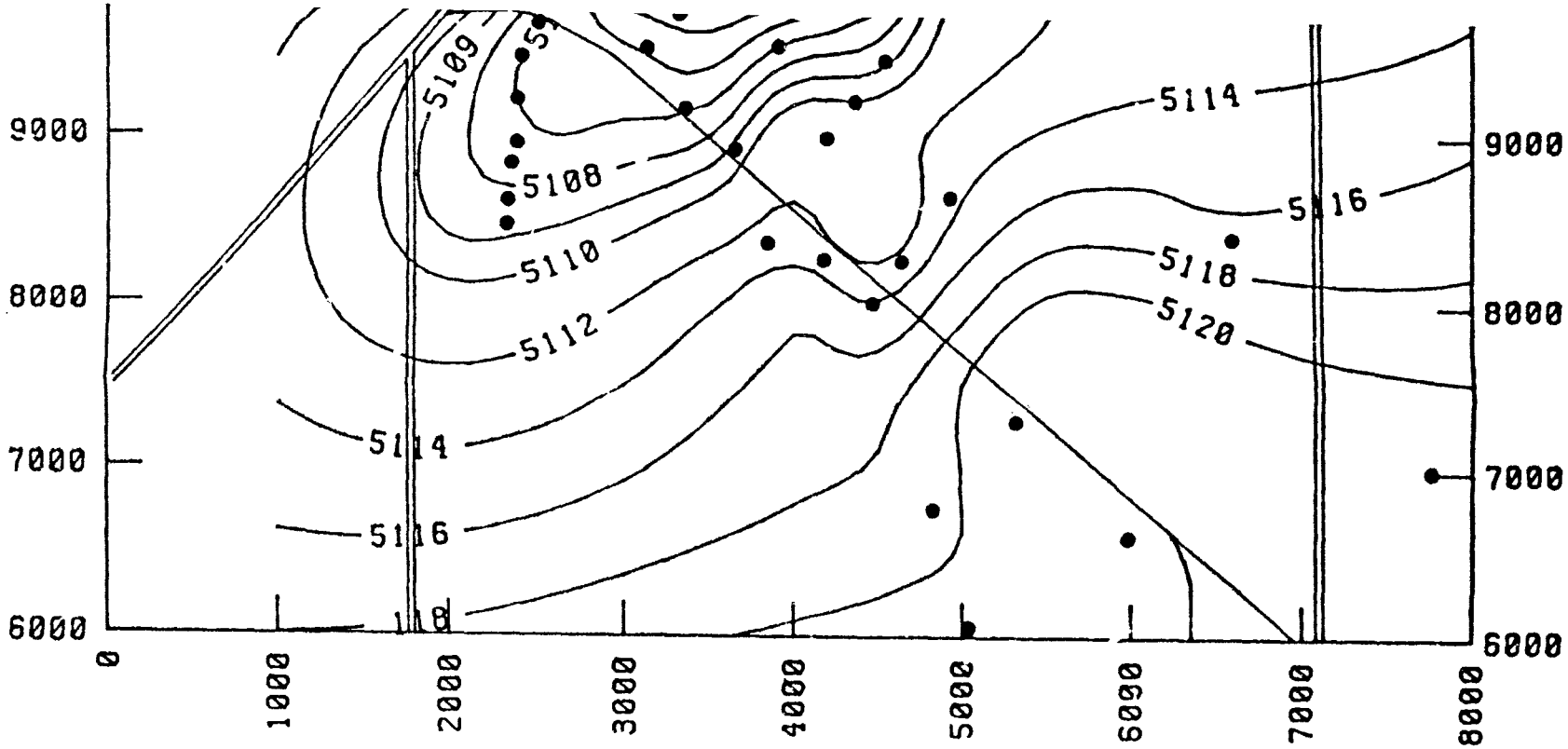
8000
10000
12000
14000



IRONDALE
WATER TABLE ELEVATION 4/88
TREATMENT SYSTEM AREA

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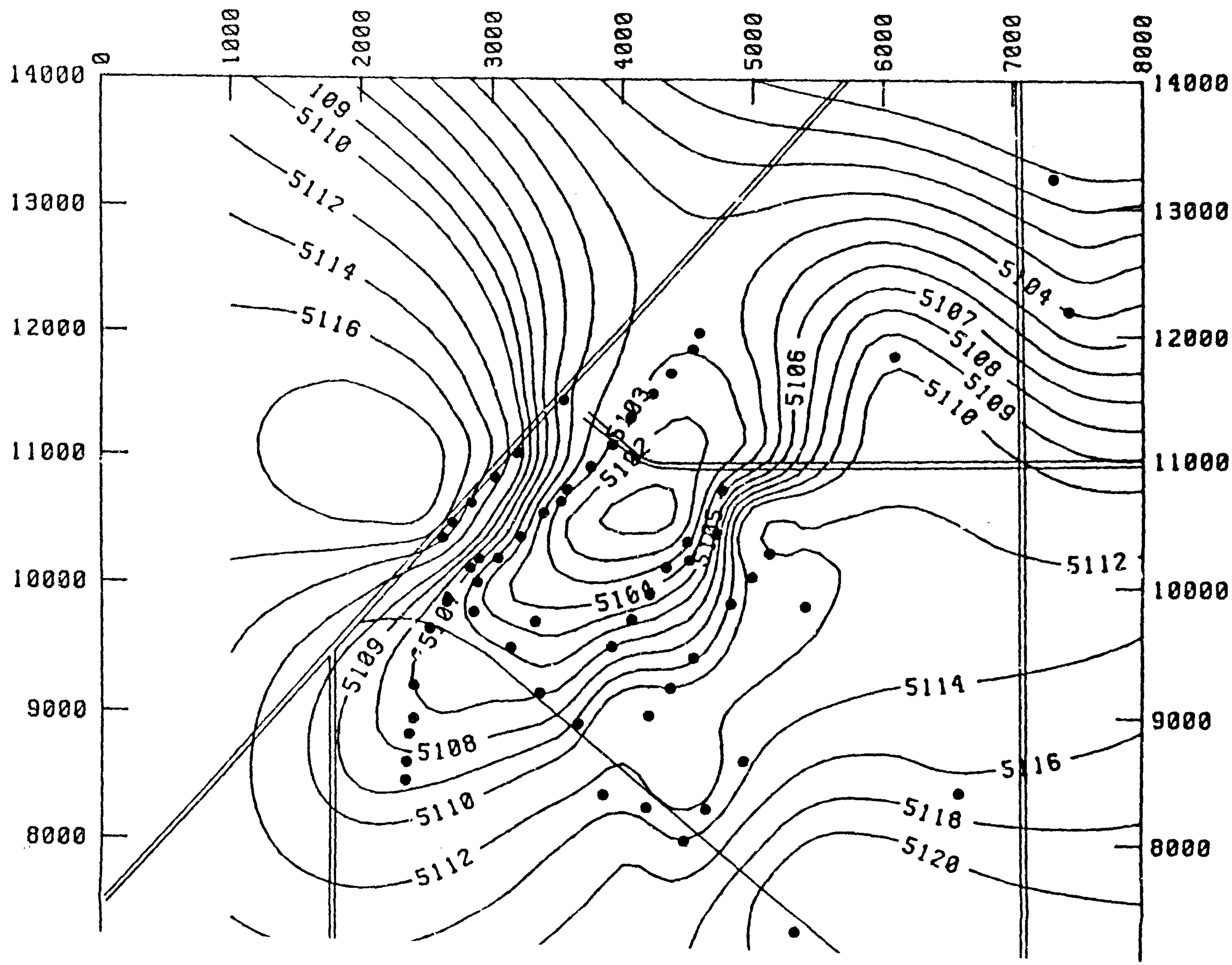
Author:	Date: 19-JAN-1989
Report:	Encl.:
File No:	



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1000
2000
3000
4000
5000
6000
7000
8000
14000
13000
12000
11000
10000
9000
8000
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5116
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5116
5118
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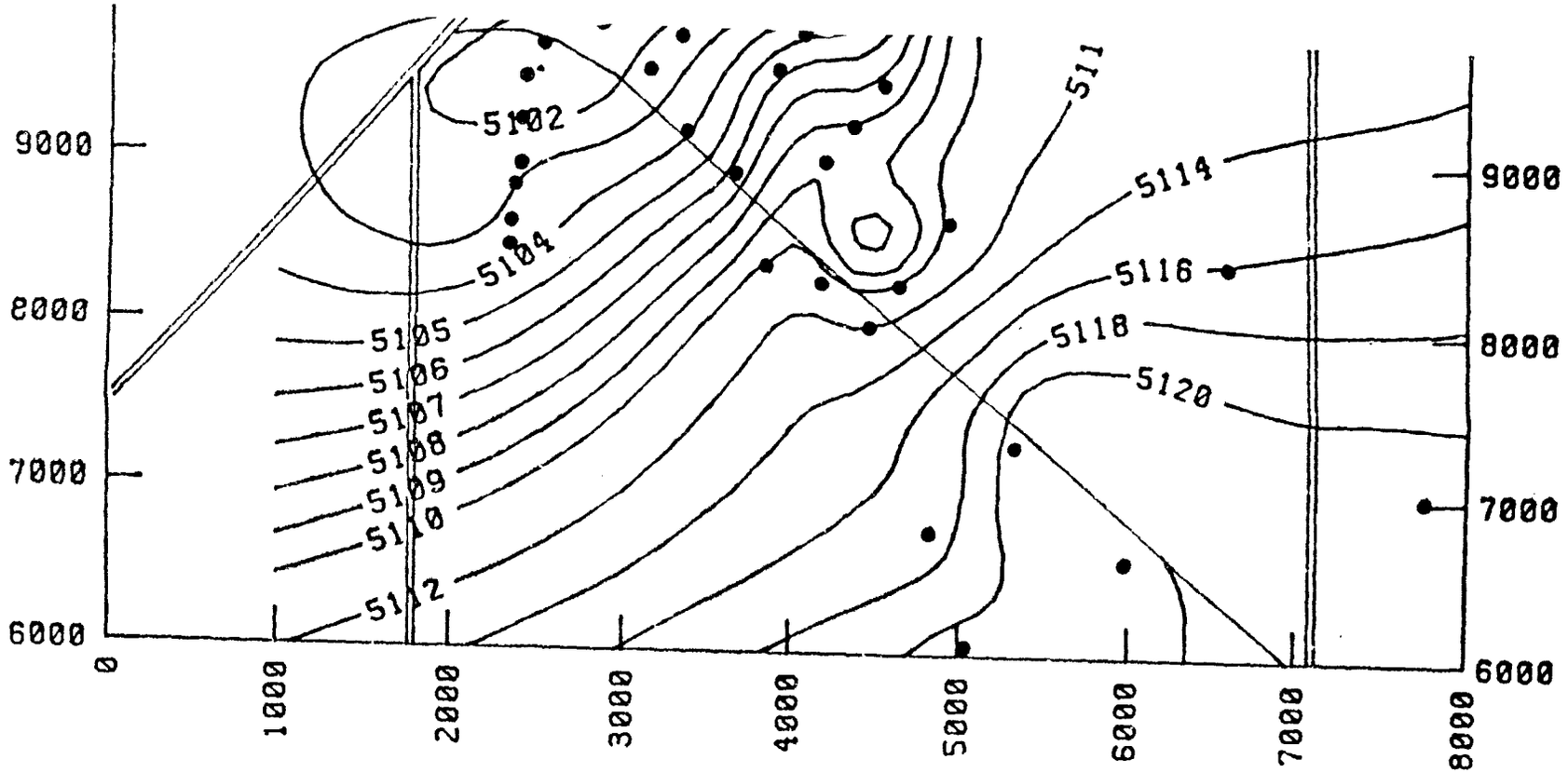
5109
5108
5110
5112



IRONDALE
WATER TABLE ELEVATION 10/88
TREATMENT SYSTEM AREA

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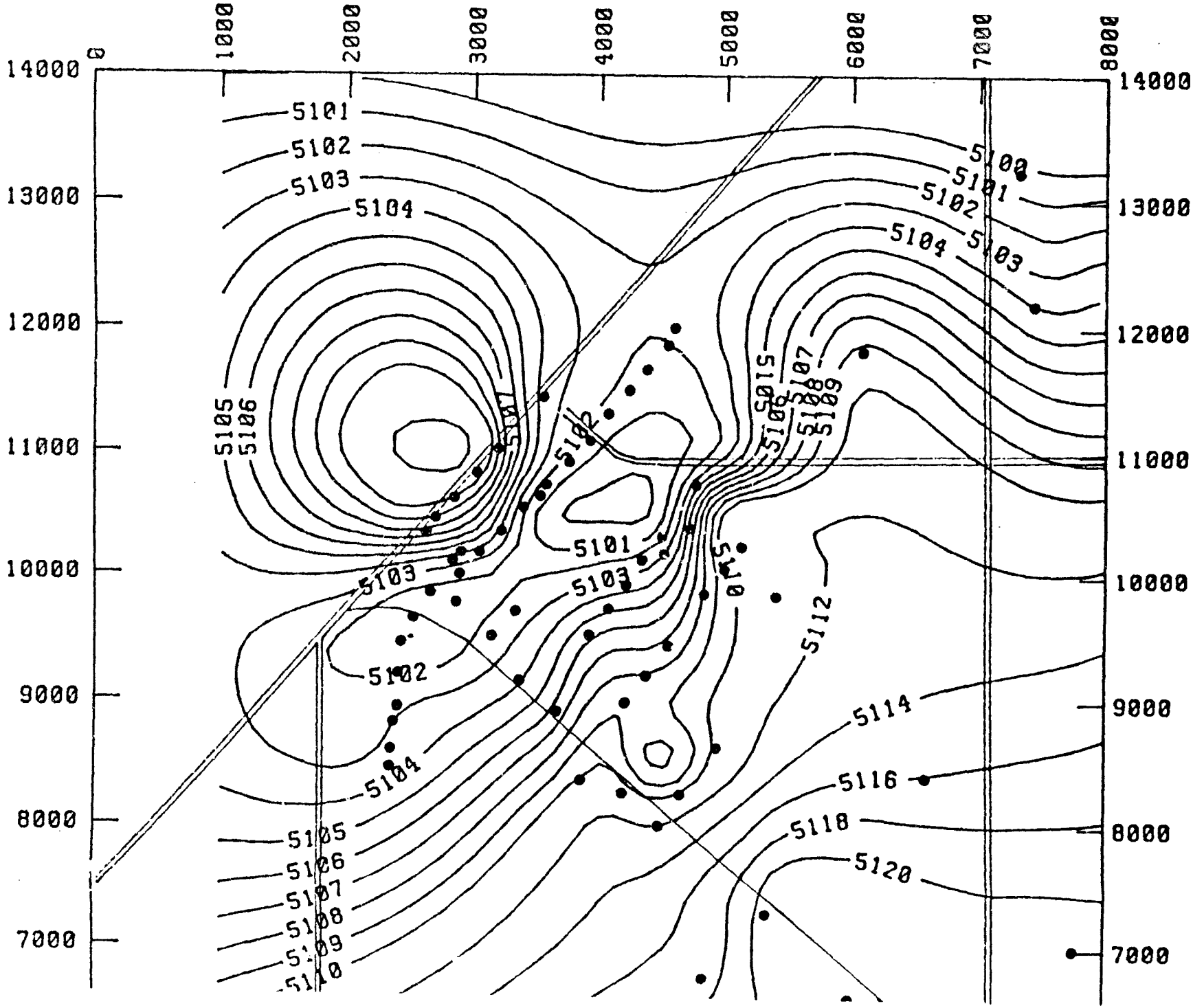
Author:	Date: 10-JAN-1989
Report:	Encl:
File No:	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8000
7000
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5102
5103
5104
5105
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5110
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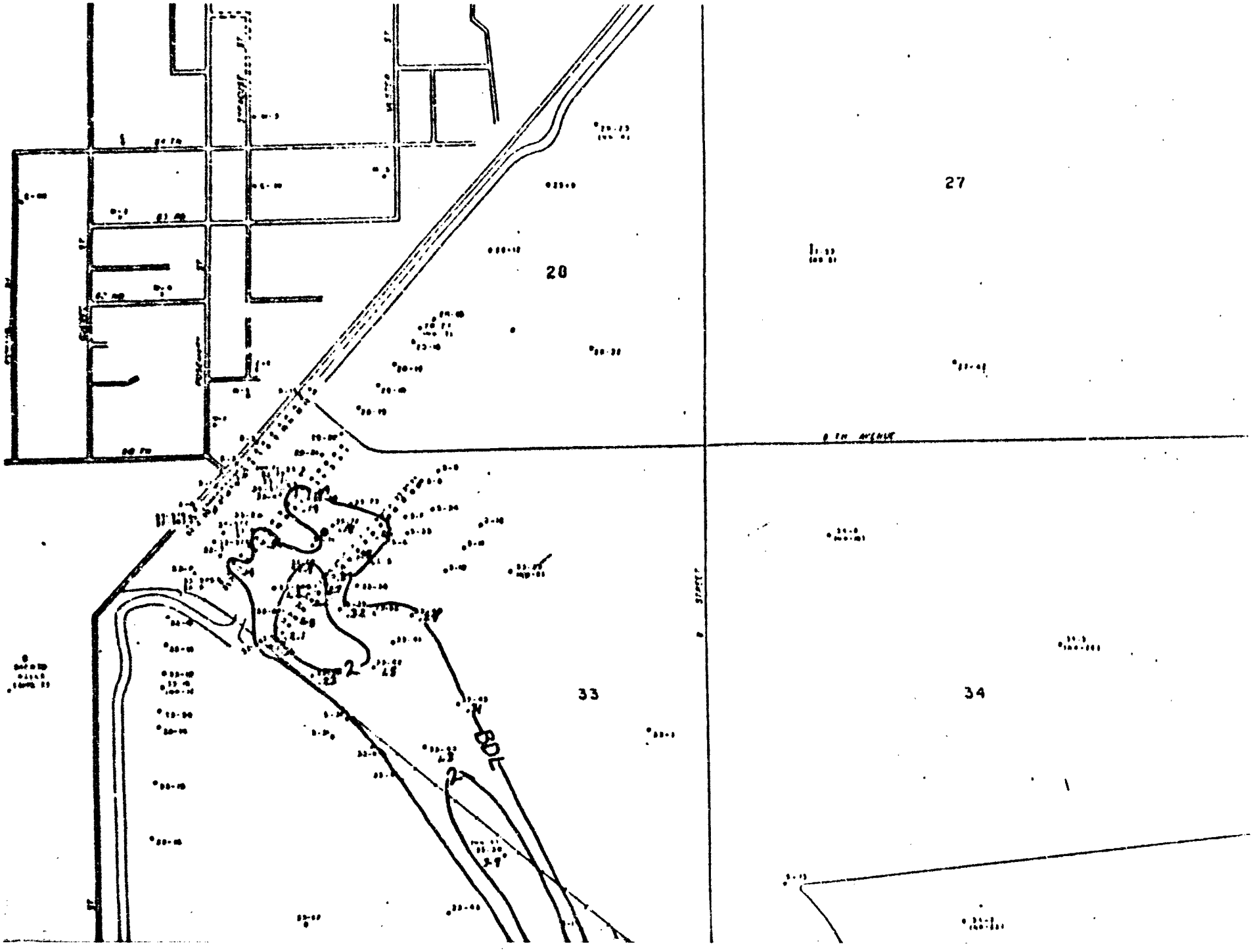
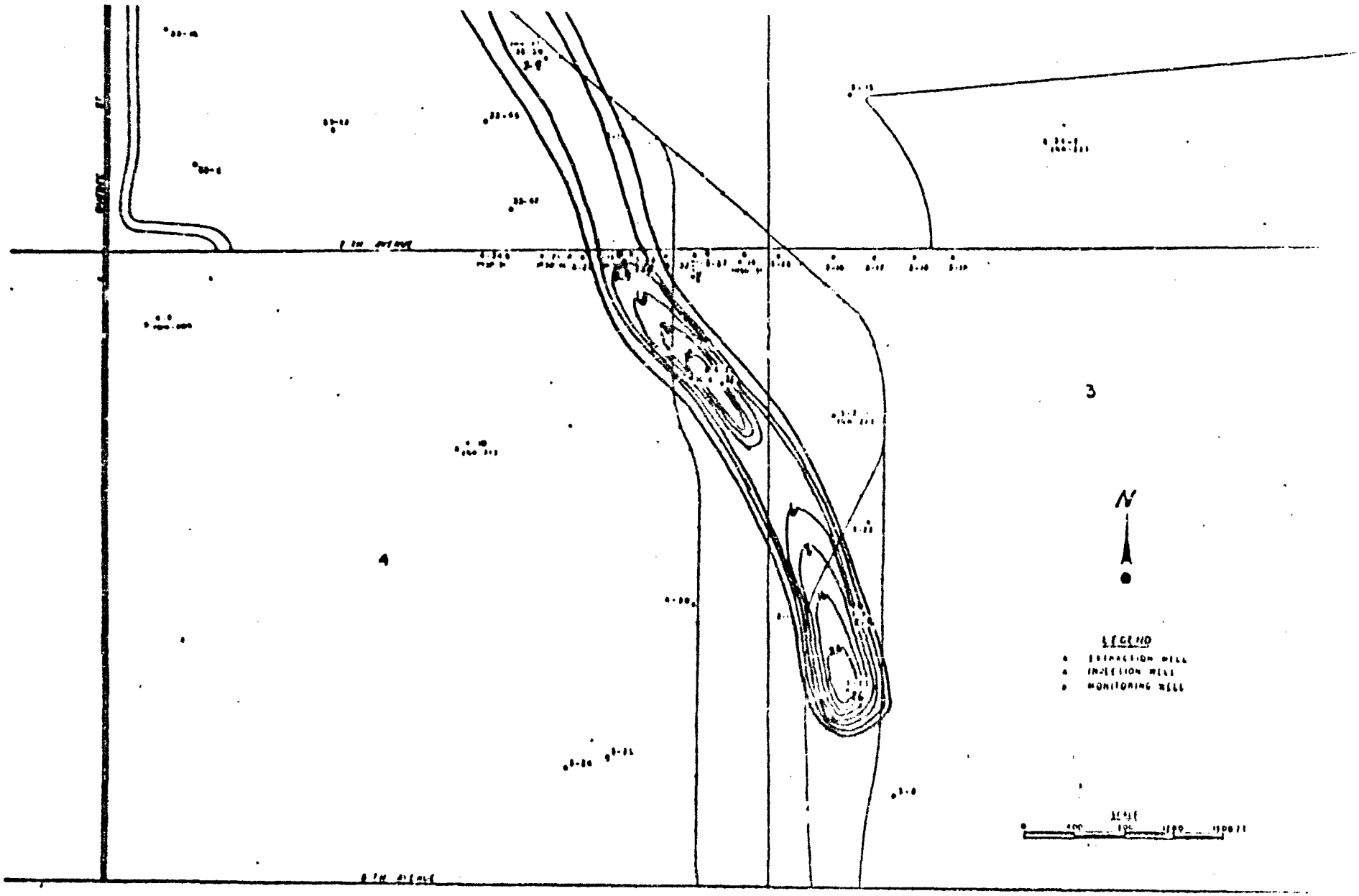
5114
5116
5118
5120

APPENDIX D
OBCP ISOCONCENTRATION MAPS


27
28
33
34
2
BDL
2

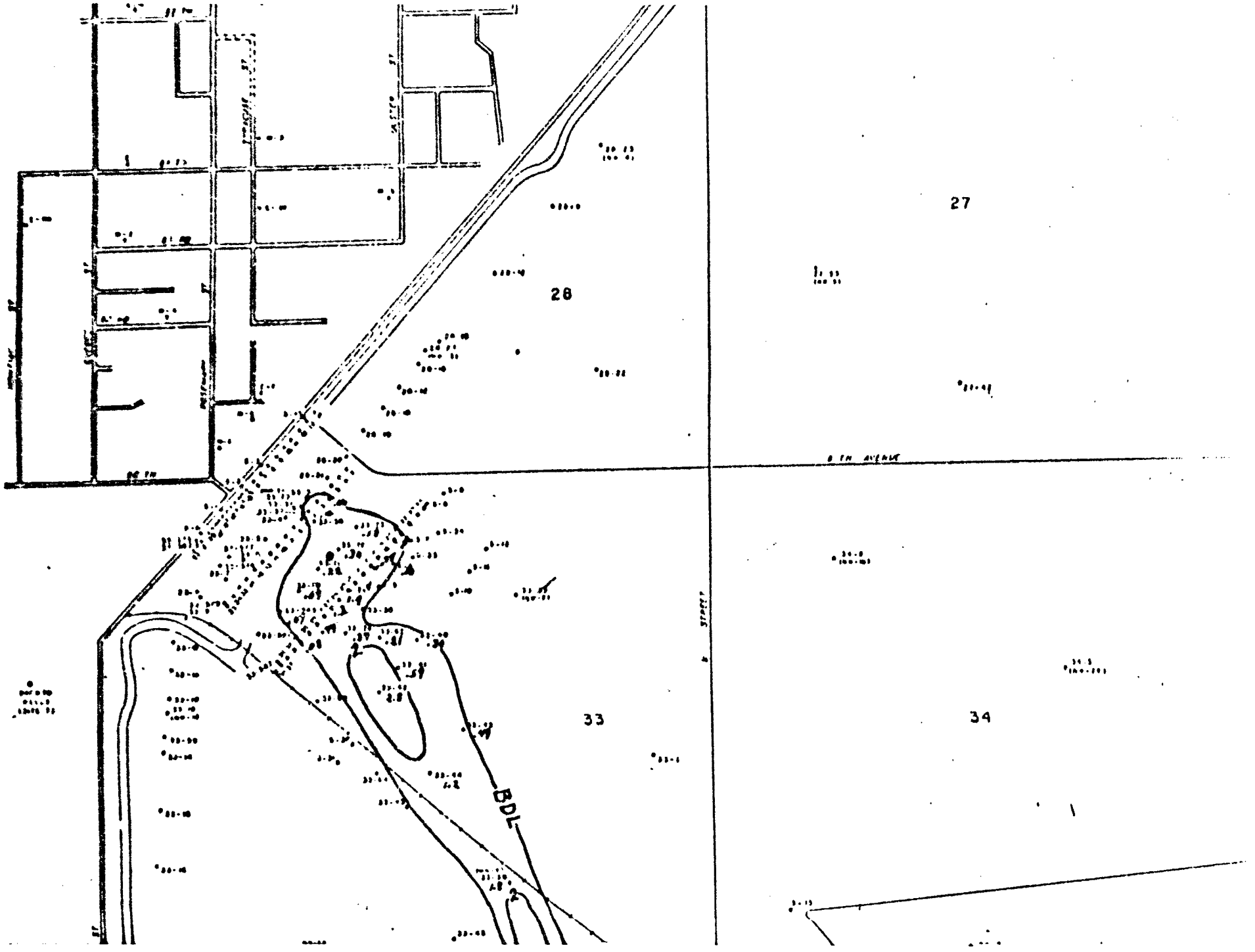


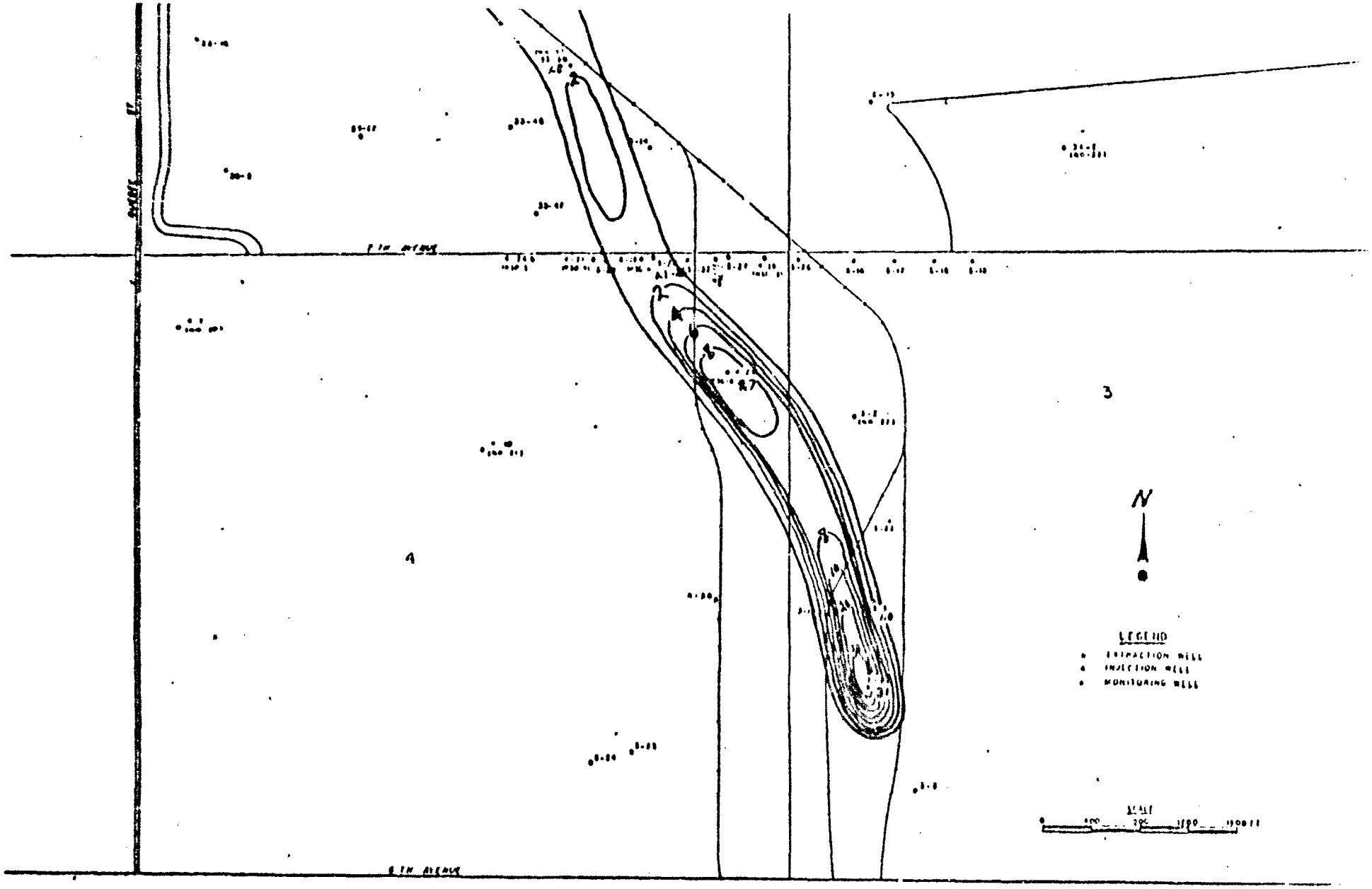
PREPARED FOR
DEPARTMENT OF THE ARMY
ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO

W. J. Crawford

DBCP Concentration Map
Contour Interval = 2 ppb
October 1988

IRONDALE DBCP CONTROL SYSTEM


27
28
33
34
BDL



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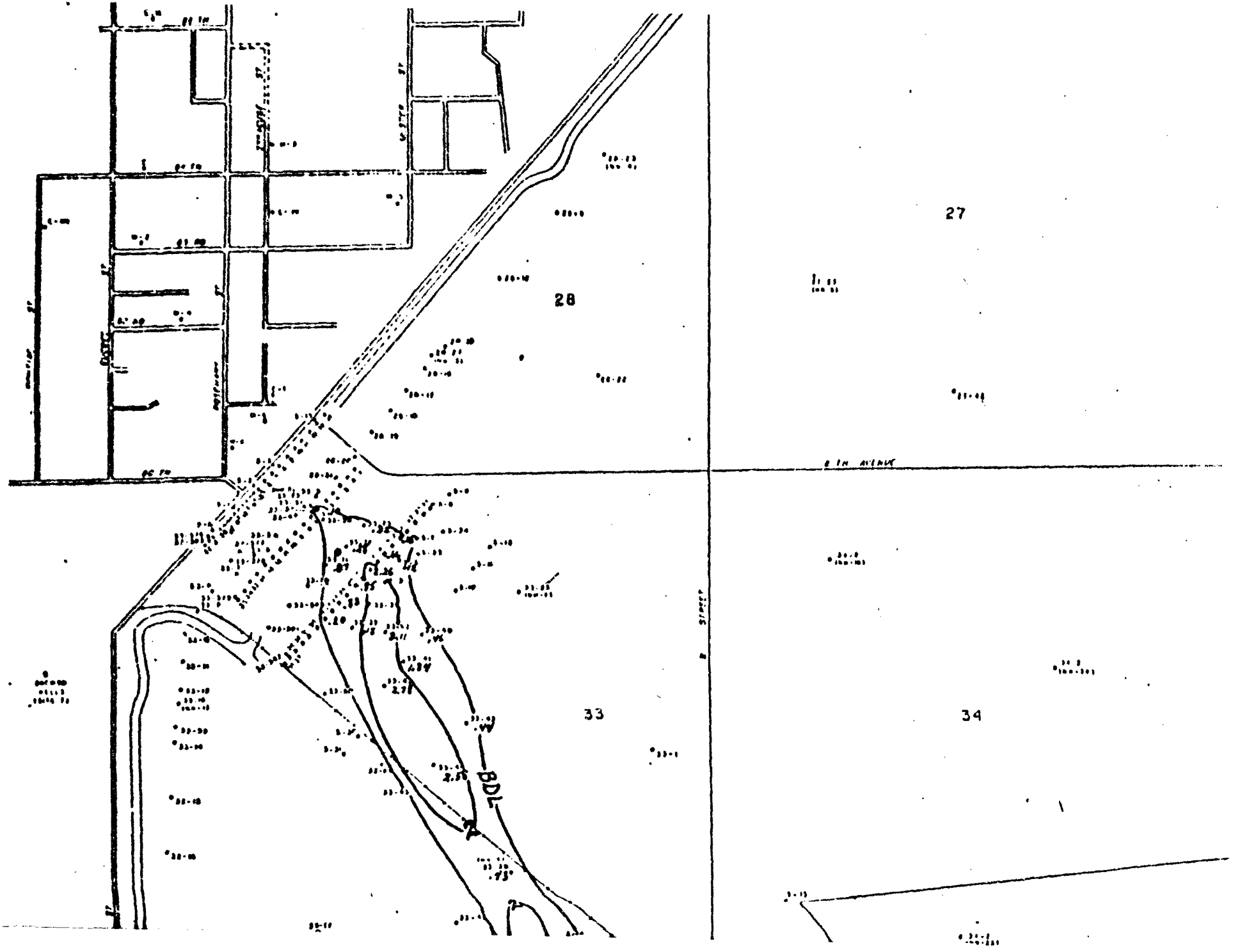
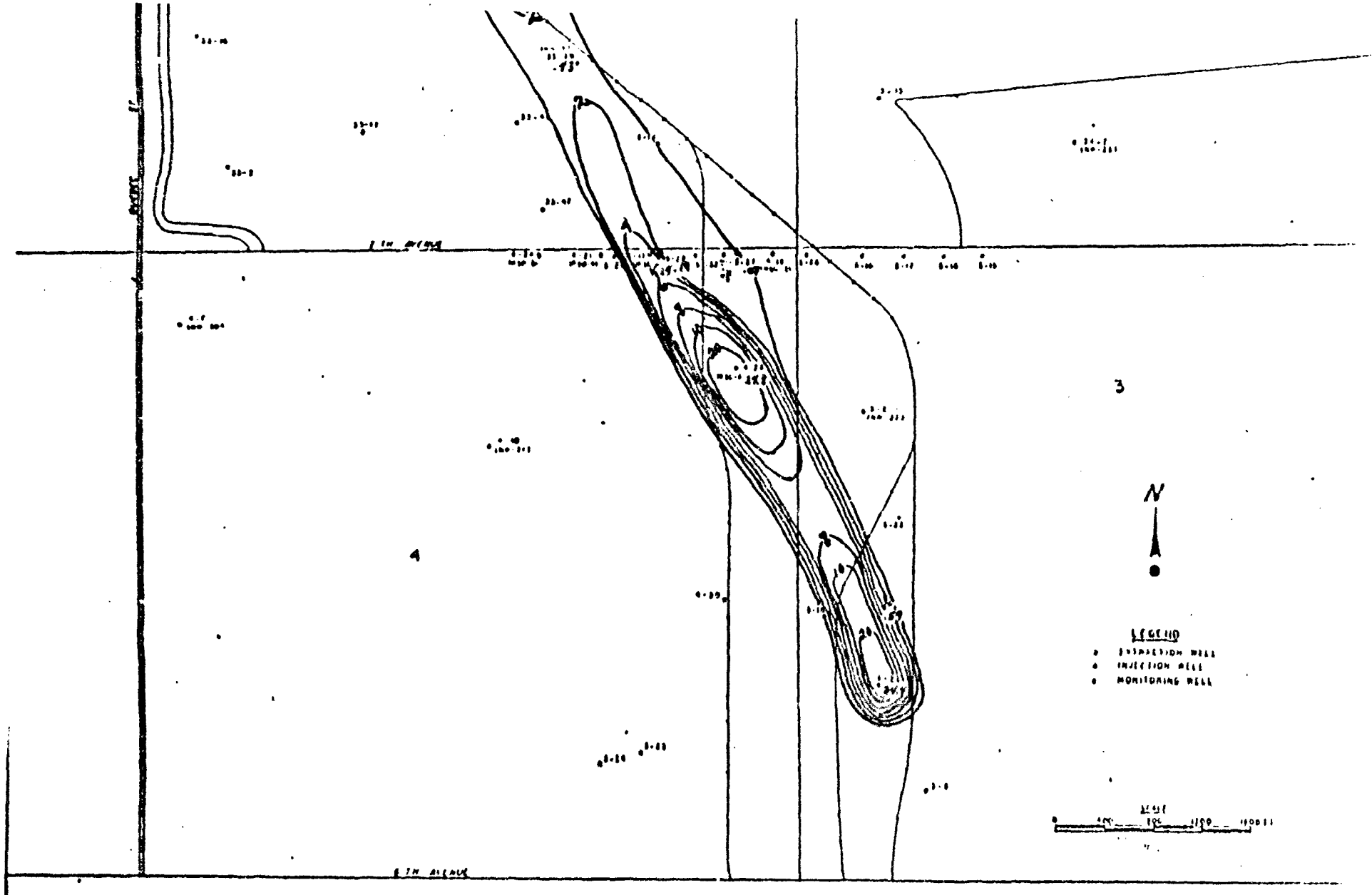
COMMERCE CITY, COLORADO

DBCP Concentration Map
Contour Interval - 2 ppb
April 1988.

IRONDALE DBCP CONTROL SYSTEM


27
28
33
34
BDL



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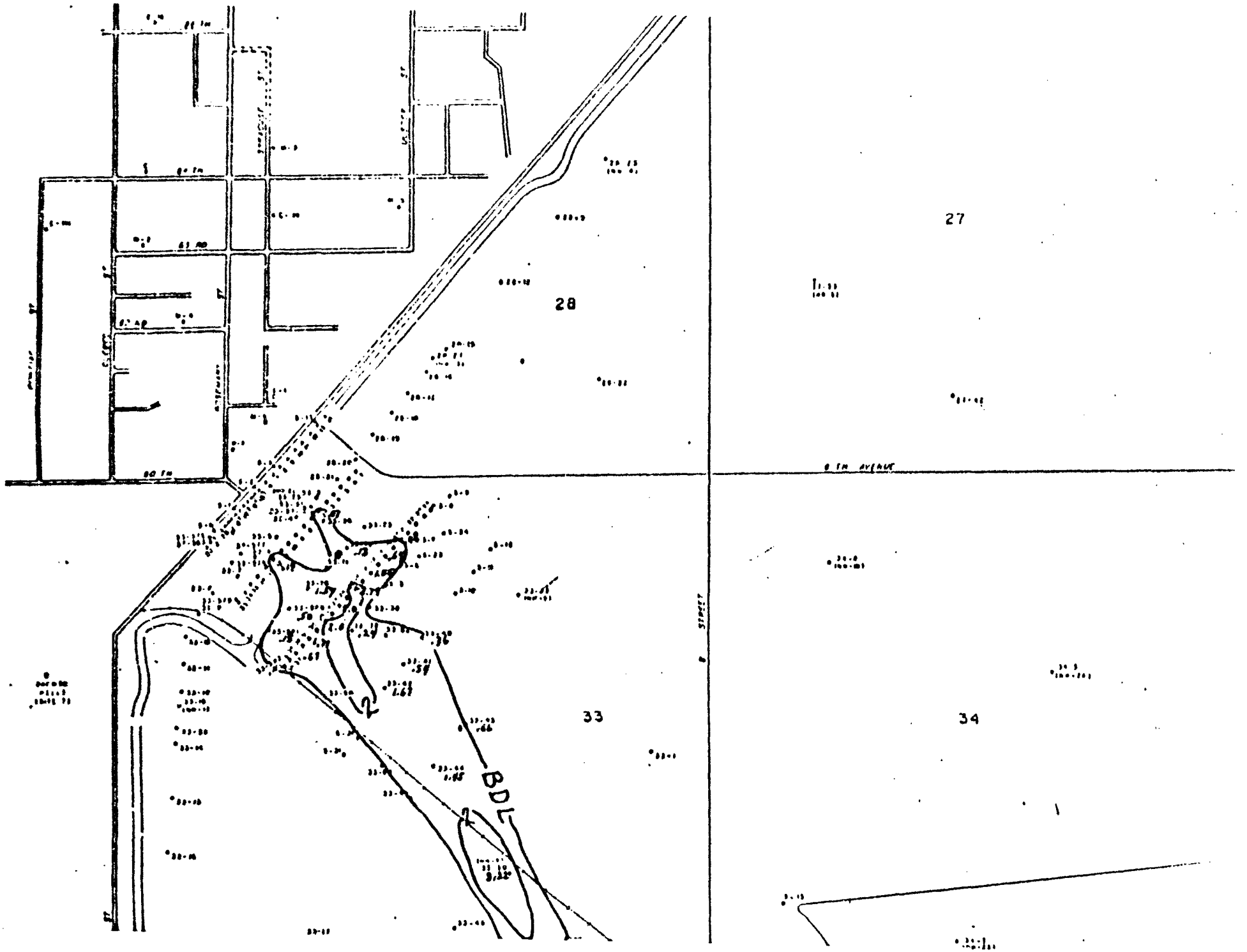
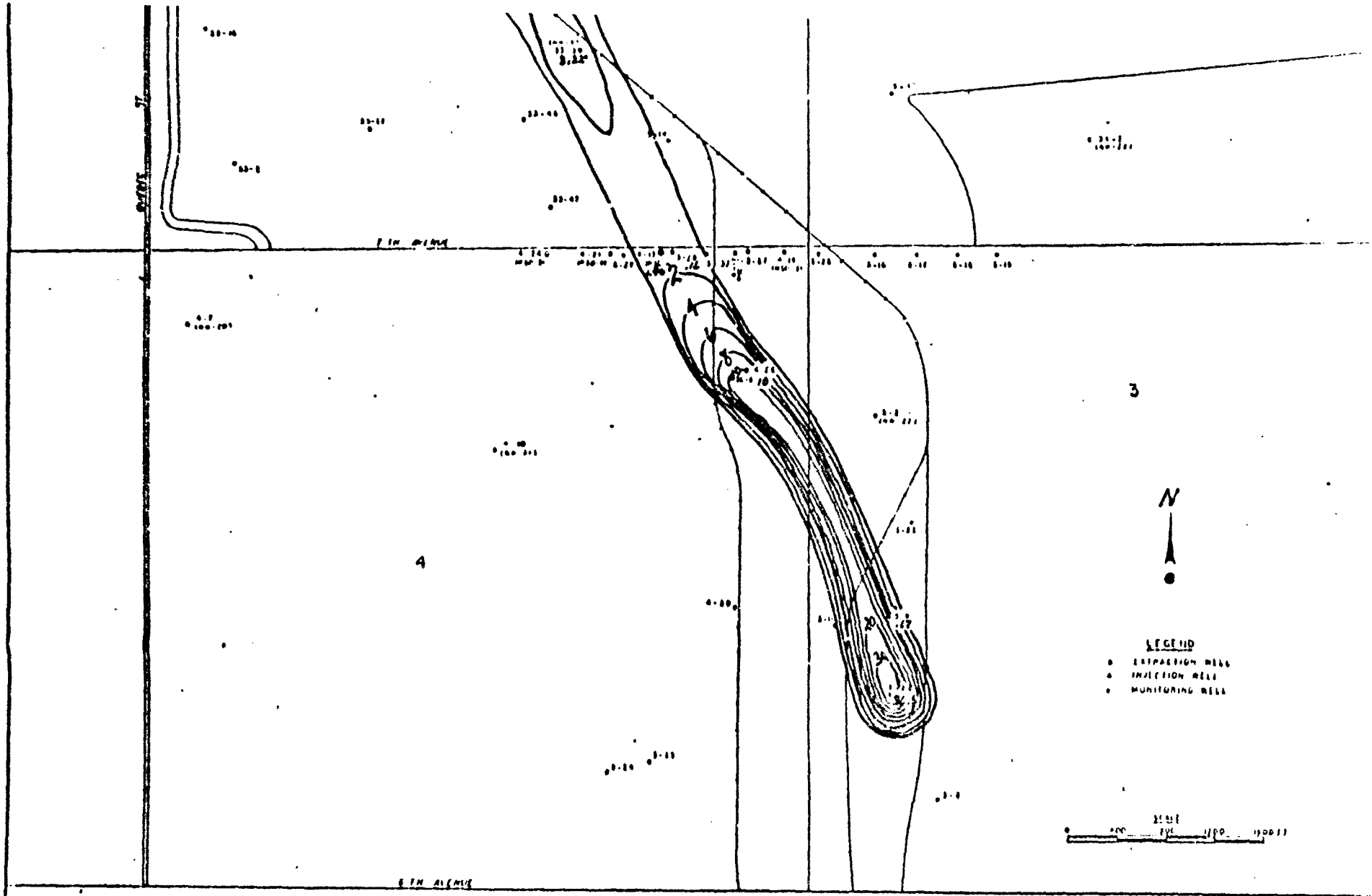
COMMERCE CITY, COLORADO

M. J. Crawford

DBCP Concentration Map
Contour Interval = 2 ppb
April 1987

IRONDALE DBCP CONTROL SYSTEM


27
28
33
34
BDL
2
9 TH AVENUE
B STREET



PREPARED FOR
DEPARTMENT OF THE ARMY
ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO

W. J. Crawford

DBCP Concentration Map
Contour Interval = 2 ppb
October 1987

IRONDALE DBCP CONTROL SYSTEM

DBCP CONCENTRATION DATA
DBCP IN PPB

Well No.	April 1988	October 1988
S-0	BDL	BDL
S-1	BDL	BDL
S-2	BDL	BDL
S-3	BDL	BDL
S-6	.10	BDL
S-7	BDL	BDL
S-10	BDL	BDL
S-13	BDL	BDL
S-14	BDL	BDL
S-23	31	26
S-26	BDL	BDL
S-27	BDL	BDL
S-28	.26	.50
S-29	BDL	BDL
S-33	BDL	BDL
3-9	1.0	2.2
Army 13	1.1	3.9
Army 15	1.3	1.3
Army 26	9.7	11
Army 28	.24	.31
26-21	BDL	BDL
33-18	BDL	BDL
33-30	1.8	3.4
33-39	.37	.32
33-40	.30	.24
33-41	.59	.44
33-42	2.8	1.5
33-43	.49	.31
33-44	1.2	1.3
33-45	BDL	BDL
33-46	BDL	BDL
33-59	BDL	BDL
33-60	BDL	.23
33-62	.21	-
33-64	BDL	BDL
33-70	.09	1.9
33-71	.22	BDL
33-72	.30	.18
33-73	.10	BDL

DBCP CONCENTRATION DATA (continued)

Well No.	April 1988	October 1988
33-576	BDL	BDL
33-577	BDL	BDL
33-578	BDL	BDL
33-579	BDL	BDL
33-580	.07	1.2
33-581	BDL	BDL
33-582	BDL	BDL
33-583	BDL	BDL
Extraction		
W-2	.12	.09
W-4	.06	BDL
W-8	BDL	.14
W-10	BDL	BDL
W-12	BDL	.56
W-14	BDL	BDL
W-33	BDL	.14
W-34	-	-
W-35	BDL	BDL
W-16	1.4	.98
W-18	.35	.26
W-20	.09	BDL
W-25	1.4	2.7
W-27	1.3	.89
W-29	.49	2.6
W-31	.08	2.5
W-36	BDL	2.1
W-37	-	-
W-38	BDL	.30
Off RMA		
M-1	BDL	BDL
M-2	BDL	BDL
M-3	BDL	BDL
M-4	BDL	BDL
M-5	-	BDL
M-6	BDL	BDL
C	BDL	BDL
C-III	BDL	BDL

(1) BDL = below detectable limit of .06 ppb
(2) P = less than .20 ppb but above detectable limit

DBCP CONCENTRATION DATA (continued)

Well No.	April 1987	October 1987
33-576	BDL	BDL
33-577	BDL	BDL
33-578	BDL	BDL
33-579	BDL	BDL
33-580	BDL	.50
33-581	BDL	.15
33-582	BDL	.11
33-583	BDL	BDL
Extraction Wells		
W-2	.10	.07
W-4	BDL	BDL
W-8	BDL	BDL
W-10	BDL	BDL
W-12	BDL	BDL
W-14	BDL	BDL
W-33	BDL	BDL
W-34	-	-
W-35	BDL	BDL
W-16	2.26	1.55
W-18	.66	.64
W-20	.15	.08
W-25	.85	2.79
W-27	.83	1.00
W-29	.20	2.00
W-31	BDL	1.71
W-36	BDL	.67
W-37	BDL	-
W-38	BDL	BDL
Off RMA		
M-1	BDL	BDL
M-2	BDL	BDL
M-3	-	BDL
M-4	BDL	BDL
M-5	BDL	BDL
M-6	BDL	BDL
C	-	BDL
C-III	BDL	BDL

(1) BDL = below detectable limit of .06 ppb
(2) P = less than .20 ppb but above detectable limit

DBCP CONCENTRATION DATA (CONTINUED)

Well No.	April 1987	October 1987
S-0	BDL	BDL
S-1	BDL	BDL
S-2	BDL	BDL
S-3	BDL	BDL
S-6	.12	BDL
S-7	BDL	BDL
S-10	BDL	BDL
S-13	BDL	BDL
S-14	BDL	BDL
S-23	24.4	36.5
S-26	BDL	BDL
S-27	.07	BDL
S-28	.19	.16
S-29	BDL	BDL
S-33	BDL	BDL
3-9	.59	.67
Army 13	2.15	1.90
Army 15	4.29	1.32
Army 26	24.8	10.0
Army 28	.31	.21
28-21	BDL	BDL
33-18	BDL	BDL
33-30	.43	3.22
33-39	.18	.24
33-40	.46	.36
33-41	1.84	.54
33-42	2.78	1.67
33-43	.44	.66
33-44	2.58	1.45
33-45	BDL	BDL
33-46	BDL	BDL
33-59	BDL	BDL
33-60	BDL	BDL
33-62	3.11	-
33-64	BDL	BDL
33-70	BDL	1.57
33-71	.07	BDL
33-72	.28	.13
33-73	.32	BDL